International Journal of
Active & Healthy Aging

e-ISSN :3023-6045
https://ndpapublishing.com/index.php/ijaha

Acute Effect of Kinesiological Taping on Condition and Mobilization in Hemiplegic Patients

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Article Info
Received: 18 March 2025
Revised: 15 May 2025
Accepted: 16 May 2025
Published: 30 June 2025

Keywords
Balance
Functionality
Hemiplegia
Posture

ABSTRACT

The purpose of this study is to examine the acute effect of kinesiology taping on functional status and mobilization in hemiplegic patients. Forty hemiplegic patients with a mean age of 18 years and over were included to the study. The patients were divided into two groups using the computerized randomization method. Kinesiology tape was applied to the first group (experimental group), and plaster tape was applied to the second group (control group). The demographic and physical characteristics of the people who agreed to participate in the study were recorded. In both groups; before taping, right after taping, 45 min. after and 4 days after taping. Posture Assessment Scale (PAS), Berg Balance Scale (BBS), Rivermead Mobility Scale (RMS) and Timed Get Up and Go Test (TUG) were administered. Both groups were asked not to remove the tapes until the end of the 4th day. According to the result of the study; balance and mobility measurements, it was observed that there were better results in the experimental group from day 1 to day 4, but the two methods we applied did not have any superiority over each other on parameters such as posture, balance, mobility, and functionality (p> 0.05). Although kinesiology tape application in hemiplegic patients gave better results than plaster tape on functionality, the result was not statistically significant. In our study, we concluded that kinesiology taping positively affects posture, walking and balance.

1. INTRODUCTION

According to the definition of the World Health Organization (WHO), stroke has been evaluated as a condition with a rapid onset, vascular origin, and causing focal or global damage to cerebral functions within 24 hours or in a longer term [1]. It is generally a condition that can radically change the lives of patients [2]. There are changeable and unchangeable risk factors affecting life in stroke cases [3].

Approximately 70% of stroke patients experience loss of function and the most common of these function losses is hemiplegia [2]. Walking function is mostly affected in patients with hemiplegia. Improvement of walking is one of the first aims after hemiplegia, but only 60-70% of patients can achieve this aim [4].

The high frequency of falls in post-stroke hemiplegic patients may be due to a combination of existing fall risk factors prior to stroke, as well as stroke-related impairments such as decreased strength and balance, hemineglect, perceptual problems, and visual problems [5].

Another factor that negatively affects the functional status of patients with post-stroke hemiplegia is the deterioration of postural symmetry. Functional impairments such as decreased dynamic stabilization and impaired weight transfer ability occur with increased postural swing during standing and sitting [6]. Somatognosis, defined as separating the right and left body posture or recognizing some parts of the body is affected in patients with post-hemiplegia. The sensory-perception problem, which is defined as asomatognosis, can cause balance problems such as the inability to perceive the body image, which has an important place in the sitting position, and the inability to make right-left direction concepts [7]. Kinesiology tapin is based on the body'm own

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How to cite this article
Karabağlı, N., Gülşen, M., Atıcı, E., and Yemisci, O. U. (2025). Acute Effect of Kinesiological Taping on Condition and Mobilization in Hemiplegic Patients. Int. J. Act. Health Aging, 3(1), 32-38.

natural healing process and provides stability by supporting muscles and joints without affecting joint movements [8]. Kinesiology taping method was first used in Japan by Kenzo Kase [9]. General properties of kinesiology tape provide adhesion to the upper layer of the skin and increase the recovery of elastic fibers and subcutaneous blood and lymph circulation. By reducing pain, it removes abnormal muscle tension and allows the fascia and muscle to return to normal [10]. When the relation of kinesiology taping with functional status was examined, it was seen that kinesiology taping instead of white athletic band had therapeutic effect, reduced pain, decreased postural reflex delay and improved dynamic balance by increasing sensory input [11]. Kinesiology taping improves the function of fascia, muscles and joints. It improves movement and coordination and increases range of motion [12]. Studies have shown that the kinesiology tape improves the postural balance of individuals by improving flexibility [13]. According to Kenzo Kase, the kinesio band affects some mechanisms in terms of functionality.

These effects;

Strengthening muscle function by strengthening weakened muscles. Removal of tissue fluid or to increase lymph and blood circulation with bleeding under the skin by moving the muscle. Reducing pain through neurological stimulation. Positioning the subluxed joints to relieve muscle tension by helping to restore fascia and muscle function [10].

The main task of the kinesio tape is to provide support during movement [14]. Kinesio tape has many features such as increasing the function of that muscle by supporting weak muscles, increasing lymphatic fluid and blood circulation, reducing pain by stimulating the neurological system, and repairing the misalignment in the joints by creating muscle contraction [15]. The aim of our study is to investigate the acute effect of kinesiology taping on functional status in hemiplegic patients.

2. MATERIALS AND METHODS

Our study was conducted on individuals aged 18 and over, who voluntarily participated in the study in the Physical Therapy and Rehabilitation Department of the Private Adana Altın Koza Hospital, continued post-stroke treatment. Kim et al. reported the Berg Balance Score (BBS) as pre-test 35.60 ± 6.81 and post-test 36.33 ± 6.36 for 15 patients in the experimental group as a result of two independent groups and repeated measurements in their study. Based on the pre-test BBS score in this study, the effect value for the same standard deviation and an average increase of 20% in the G power program was found to be 1.0608466. At this effect value, at the 90% power and 0.05 significance level, the minimum number of patients to be taken for each group is 20, and a total of 40 patients should be taken (Df = 38, Critical t = 1.6859545). With the computerized randomization system, a total of 40 people, 20 of whom we applied kinesiology taping in the first group (experimental group), and 20 of whom we applied plaster taping in the second group (control group), were determined. T max branded kinesiology tape was applied to both M. Quadriceps Femoris and M. Gastrocnemius muscles of the experimental group. Roll branded plaster tape was applied to both M. Quadriceps Femoris and M. Gastrocnemius muscles of the control group.

The inclusion criteria for the study were to agree to participate in the study after detailed information about the study, to have sufficient cognitive functions, to be diagnosed with hemiplegia by a specialist physician, to be 18 years of age or older, and exclusion criteria for ambulatory patients; diagnosis of other neurological diseases (parkinson's, multiple sclerosis, etc.), cancer disease other than hemiplegia, heart failure, surgery in the area to be applied, vascular problems in the lower extremity, chronic kidney failure, infection.

A prospective study was performed (clinicaltrials.gov number: NCT05106543). This study was approved by Başkent University Medical and Health Sciences Research Board and Ethics Committee (Project number: KA19 / 376) and supported by Başkent University Research Fund. After giving information to the individuals about the purpose of the study and the evaluations, the "Informed Consent Form" in accordance with the standards was read and their approval was obtained to be signed.

In the study, the individuals to be evaluated after grouping were informed about the purpose of the study and the measurements to be made, and their approval was obtained. Socio-demographic characteristics of the individuals were recorded. Posture rating scale to evaluate postural disorders in hemiplegic individuals, Berg Balance Scale to evaluate balance disorders, Rivermead Mobility Scale to evaluate mobility disorders, and timed get up and go test to evaluate gait disorders. All evaluations were applied to both groups before taping, immediately after taping and 45 minutes after taping. Patients in both groups were asked not to have their tapes removed until the 4th day. All patients were re-evaluated on the 4th day. Apart from routine physical therapy methods and taping, no other treatment was applied to the individuals.

1.1. Posture Assessment Scale

Posture assessment scale is an assessment method that can easily measure balance even in hemiplegic patients with little physical activity. It contains 12 items that measure the balance performance of the patient while lying, sitting, standing, or changing standing position. The scale is examined under two headings: 1-Maintaining the posture, 2-Posture change.

It is examined under the headings of sitting without support, standing with support, standing without support, standing on the sick and intact leg, and maintaining the posture. Actions such as turning lateral to the patient and the healthy side on the back, coming to sit from the back, returning to the lying position without sitting, standing from sitting, sitting from standing, and taking the pencil on the floor while standing are also examined under the change of posture. The scale is scored between 0 and 36. Movement feasibility is tested between 0-3 points. 0 points are the lowest 3 points are the highest points. When the questions on the scale are directed, the patient is given 0 points if he cannot do it, but 3 points are given if he can do it completely [16]. Posture assessment scale has been stated as a scale with proven validity and reliability [17].

1.2. Berg Balance Scale

The berg balance scale was used to measure the balance of the patients. The scale consists of 14 items and is scored between 0-4 points. 0 is the lowest and is considered to be "unable", 4 is the highest score and is considered to be "able to do it independently". The highest score people can get from this test is 56. Scores between 0-20 indicate imbalance, scores between 21-40 indicate that the balance is acceptable, and 41-56 indicates a good balance [18]. In the study of Judge et al., It was reported that Berg balance scale has excellent intra- and inter-investigator validity and reliability in the evaluation of functional standing balance in the elderly [19].

1.3. Rivermead Mobility Scale

Rivearmead mobility scale was used to measure the mobility of the patients. This scale consists of 14 questions and 1 observation. It includes activity from turning to running in bed. Only item 5 is evaluated by the observer. For each yes answer, 1 point is given and points between 0-15 can be obtained. 15 points indicate that there is no problems in mobility, 14 points and below indicate that there is a problem with their mobility. Its validity and reliability in Turkish was demonstrated by Akın et al. [20].

1.4. Timed Get Up and Go Test

The stand up and go test was applied to evaluate the patients' standing up and walking. In the timed get up and go test, a point 3 m away from the chair where the participant is sitting is marked and the patient is asked to get up from the chair, walk 3 m and return to the chair again. The patient is measured with the completion time of the test. 14 seconds or more indicates a high risk of falling [21]. In the study conducted by Shumway-Cook, they evaluated the validity and safety of the timely get up and go test in evaluating balance disorders in the elderly and determining their falls, and stated that the test was valid and safe [22].

1.2. *Statistical Analysis*

Frequency analysis was used to define nominal and ordinal data in the study. Scale scores were defined with mean and standard deviation values. Chi-Square Test and Chi-Square Likelihood Ratio were used for ordinal and nominal data in difference analysis. Before the difference analysis of the measurement data, the normality distribution was examined with the Kolmogorov Smirnov test. The Independent Sample T-test was used for the difference of normally distributed parameters between the two groups The dual group aware Mann Whitney U test was used for parameters that did not conform to normal distribution. Spearman's rho correlation was used in correlation analysis. All analyzes were performed in SPSS 17.0 for Windows program at 95% confidence interval. The research has been done one-tailed. Paired Sample T-Test was used for normally distributed data, and Wilcoxon Signed Rank Test was used for parameters that were not normally distributed.

3. RESULTS

The distribution of demographic characteristics of the experimental and control groups and the results of the difference analysis were given in Table 1.

The age, weight, height and BMI of the experimental group were higher than the control group. However, the difference analysis results showed that all these differences between the groups were not statistically significant ($p > 0.05$) (Table 1). The distribution of the 1st and 4th day Posture Evaluation Scale (PBI) scores and the difference analysis results of the patient groups were given in Table 2.

Table 1. Distribution of some demographic characteristics of the experimental and control groups and the results of the difference analysis

	Group I		Group II		p
	Mean	**Std. Deviation**	**Mean**	**Std. Deviation**	
Age	63.75 ±	13.91	63.50 ±	8.57	0.946[a]
Weight	72.75 ±	10.14	71.10 ±	6.07	0.537[a]
Height	166.95 ±	7.78	166.90 ±	5.79	0.982[a]
BMI	26.09 ±	3.28	25.57 ±	2.34	0.567[a]
	Frequency (n)	**Percent (%)**	**Frequency (n)**	**Percent (%)**	
Gender					
Male	13	65.0	8	40.0	0.113[b]
Female	7	35.0	12	60.0	
Clinical diagnosis					
Right	10	50.0	10	50.0	p>0.05
Left	10	50.0	10	50.0	

a. Independent Samples T-Test, b. Chi-Square Test.

Table 2. The distribution of the 1st and 4th day Posture Evaluation Scale (PBI) scores and the difference analysis results of the patient groups

	Study			Control			p
	Mean		**Std. Deviation**	**Mean**		**Std. Deviation**	
1st day							
Before Taping	27.30	±	2.27	27.05	±	1.99	0.799[a]
Just after taping	27.30	±	2.27	27.05	±	1.99	0.799[a]
45 min after taping	27.30	±	2.27	27.05	±	1.99	0.799[a]
4th day	**27.65**	**±**	**2.81**	**27.05**	**±**	**1.99**	**0.441[b]**

a. Mann Whitney U Test Non-parametric, b. Independent Samples T-Test Parametric

Posture evaluation scores of the experimental group before, immediately after and 45 minutes after the tape were higher than the average values of the control group on the first day. The mean posture assessment scores on the 4th day were higher in the experimental group than the control group. However, according to the results of the difference analysis, all these differences are not statistically significant (p> 0.05) (Table 2).

Spearman's rho correlation analysis results for the relationship between the 4th day posture evaluation scores, balance scores, mobility scores and functionality scores according to the patient groups were given in Table 3.

Table 3. Spearman's rho correlation analysis results for the relationship between the 4th day posture evaluation scores, balance scores, mobility scores and functionality scores according to the patient groups (r values)

	Study				Control			
4th day	**Posture**	**Balance**	**Mobility**	**Functionality**	**Posture**	**Balance**	**Mobility**	**Functionality**
Posture	-	0.941**	0.793**	-0.458*	-	0.820**	0.938**	-0.789**
Balance	0.941**	-	0.675**	-0.325	0.820**	-	0.894**	-0.717**
Mobility	0.793**	0.675**	-	-0.675**	0.938**	0.894**	-	-0.770**
Functionality	-0.458*	-0.325	-0.675**	-	-0.789**	-0.717**	-0.770**	-

***p<0.05 **p<0.01 Spearman's correlation analysis**

According to the results of correlation analysis, there was a statistically significant and positive (p <0.01) relationship between Posture and Balance and Mobility in the Experiment and Control groups, and a negative relationship with functionality (p<0.05). There was a statistically significant and positive correlation between balance and mobility (p<0.01). There was a statistically significant and negative correlation between mobility and functionality (p <0.01) (Table 3). The relationship between the scores of each procedure scale before the treatment (1st day before the band) and the end of the 4th day was given in Table 4.

Table 4. The relationship between the scores of each procedure scale before the treatment (1st day before the band) and the end of the 4th day (r values)

	Before Taping Posture 1st day	Before Taping Balance 1st day	Before Taping Mobility 1st day	Before Taping Functionality 1st day	Posture 4th day	Balance 4th day	Mobility 4th day
Before Taping Denge 1st day	**0.837****	10.000	**0.793****	**-0.616****	**0.869****	**0.999****	**0.793****
Before Taping Mobility 1st day	**0.771****	**0.793****	10.000	**-0.828****	**0.834****	**0.791****	10.000
Before Taping Functionality 1st day	**-0.603****	**-0.616****	**-0.828****	10.000	**-0.645****	**-0.611****	**-0.828****
Posture 4th day	**0.955****	**0.869****	**0.834****	**-0.645****	10.000	**0.873****	**0.834****
Balance 4th day	**0.837****	**0.999****	**0.791****	**-0.611****	**0.873****	10.000	**0.791****
Mobility 4th day	**0.771****	**0.793****	10.000	**-0.828****	**0.834****	**0.791****	10.000
Functionality 4th day	**-0.530****	**-0.497****	**-0.708****	**0.882****	**-0.582****	**-0.493****	**-0.708****

**p<0.01 Spearman's correlation analysis

According to the results of correlation analysis, there was a statistically significant and positive relationship between 1st day Posture and the 4th day Posture, Balance and Mobility, and a negative relationship with functionality (p <0.01). There is a statistically significant and positive relationship between pre-treatment balance and 4th day Posture, Balance and Mobility, and a negative relationship with functionality (p <0.01). There was a statistically significant and positive relationship between mobility before treatment and posture, balance and mobility on day 4, and a negative relationship with functionality (p <0.01). There is a statistically significant and negative relationship between pre-treatment functionality and 4th day Posture, Balance and Mobility, and a positive relationship with functionality (p <0.01) (Table 4).

4. DISCUSSION

Kinesiology taping has been used in many areas and in the treatment of many diseases, in addition to rehabilitation, to reduce symptoms, improve functionality and increase the effectiveness of treatment in recent years [23]. When we look at the literature, in kinesiological taping applications investigated in hemiplegic patients; In general, it is aimed to improve hand functions, increase muscle activity, reduce shoulder pain, and regulate muscle tone in the upper extremity. It is aimed to increase posture and muscle activity, improve balance and regulate muscle tone [24]. Koseoglu et al. conducted a research to examine the effects on rehabilitation by applying kinesiological taping to the tibialis anterior muscle in hemiplegic patients. Twenty hemiplegic patients were included in the study. They conducted the study by dividing into 2 groups; A kinesiology tape was applied to the tibialis anterior muscle of the first group and additionally, a physical therapy program was applied. In the second group, only physical therapy program was applied 5 days a week for 4 weeks. As a result of the examination, they found that the effects of the 1st group on posture and spasticity in the lower extremities, motor functions and activities of daily living were better than the control group [25]. In our study, no additional physical therapy or other application was performed. Kinesiology taping was applied only to the experimental group and only to the control group, and the effect of this banding was observed just after taping, 45 minutes after taping and 4 days after taping. Koca et al. examined the acute effect of kinesiological taping on mobility and hand functions in hemiplegic patients and used the stimulation muscle technique to the forearm extensor muscles. As a result of the examinations, they reported that the kinesiological tape had a positive effect on mobility hand functions and hand grip strength [26]. In our study, kinesiology taping was applied to the lower extremity, unlike the studies in the literature that showed a positive effect on upper extremity functions [26, 28].

Szczegielniak et al. evaluated the effect of kinesiological taping on walking in people with acute hemiplegia by testing the 10-meter walking test. Thirty hemiplegic patients, 15 males and 15 females, between the ages of 53 and 70 participated in the study. Therapeutic kinesiology tape was

applied to the participants to correct drop foot while walking. The gait of the participants was examined before, 1 hour and 1 day after taping. As a result of the research, walking time values obtained before, 1 hour after and 1 day after taping were compared. As a result, they stated that taping was statistically significant on walking. They argued that kinesiology taping has a corrective effect [27]. In a study, tape therapy was applied to hemiplegia patients for 4 weeks, and observed a statistically significant improvement in pain intensity, muscle activity and active range of motion in the group receiving tape therapy [28]. The study was conducted with 10 kinesiology taping and 9 control groups. Other study reported that the speed, stride width and length of the football players were statistically significantly higher in the kinesiological taping group for ankle sprain [29]. In another study, the effect of kinesiological taping on walking ability in patients with foot drop after stroke was observed. In the study, 10 meter walking and Stop and Go tests were applied. According to the results of the study, kinesiology taping after stroke significantly improved walking functions [30]. Liao et al. [31] examined the effect of kinesiology taping on body balance, mobility and walking in patients after stroke. According to the results obtained in the study, kinesiology taping gave statistically significant and effective results in a short time in body functions and balance parameters. Bae et al. [32] examined the effect of kinesiology taping on balance in patients with stroke and foot drop. In the study, kinesiology taping provided a positive and statistically significant effect on static balance. Park et al. [33] examined the effects of calf muscle taping on pressure in patients with chronic stroke. According to the results obtained in the study, kinesiology taping had a significant effect on the forward and backward pressure changes during walking in chronic stroke patients. In another study, Shin et al. [34] examined the effect of kinesiology taping on dynamic and static balance in patients with foot drop after stroke.

5. Conclusion

According to the results of the study, kinesiology taping provides statistically significant improvements in static and dynamic balance and walking skills in errors with foot drop after stroke. As a result; they stated that functional parameters and the reason for the inability of gait to improve may be related to many complex events such as functional parameters, proprioception and balance. In our study, we concluded that kinesiology taping positively affects posture, walking and balance. More time and more different parameters are needed to achieve a positive result in the lower extremity, and more studies should be conducted in this direction.

Conflict of Interest

No conflict of interest is declared by the authors. In addition, no financial support was received.

Ethics Committee

This study followed ethical standards. Participant provided informed consent, with the volunteer form covering research details, risks, benefits, confidentiality, and participant rights.

Author Contributions

Conception and design of the study: NK; Data collection: NK; Literature Search: OÜY, MG; Data analysis: MG, EA; Data Interpretation: OÜY, EA; Drafting the article and/or its critical revision: MG, EA, NK; All authors have read and agreed to the published version of the manuscript.

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