

## The Effects of Kinesio Taping in Handgrip Strength

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**Abstract** – Developed by Dr. Kenzo Kase, the Kinesio Taping method originated from the hypothesis of an external component aiding in muscle activity and functions of other tissues. Some authors state that due to its elastic properties, the Kinesio Taping method promotes skin traction which stimulates mechanoreceptor communication, and therefore improves muscle strength. This study aimed to assess the effects of Kinesio Taping in bilateral grip strength in healthy women by means of handgrip dynamometry. This research represents an experimental, analytical, and quantitative study, in which 75 women participated. The subjects, aged 18 to 30 years, were divided into 3 groups: Kinesio, Kinesio without tension, and control, and were assessed before intervention and 30 minutes, 24 hours, and 48 hours afterward. The results demonstrate an increase in handgrip strength with the use of Kinesio Taping after 30 minutes, 24 hours, and 48 hours of application when compared to control. A statistically significant increase in strength was observed in the Kinesio group in comparison to control after 24 hours and 48 hours for the right hand, and after 48 hours for the left hand. The improvement in the Kinesio group in relation to Kinesio without tension was observed only after 24 hours of the taping application, and only on the right hand. The dominant hand presented greater handgrip strength during all assessments between all groups. It is concluded that the Kinesio Taping method augmented handgrip strength in healthy women and maintained it elevated during all times of measurement after application, while the dominant hand also demonstrated the greatest strength values.

Keywords: Kinesio Taping, handgrip strength, muscle strength

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## INTRODUCTION

It is a consensus that the search for new therapeutic approaches capable of preventing and treating musculoskeletal dysfunctions is progressively increasing in conjunction with current technological innovations. In this context, the application of taping techniques was elaborated as a complement to the treatment of such dysfunctions, and was innovated over time in order to provide therapeutic effects without hindering functionality of the particular body segment.

In this manner, Dr. Kenzo Kase developed in 1973 a compliant tape with elastic properties similar to the skin, and named it Kinesio Tape (OSTERHUES, 2004; BELLIA, 2006; RIBEIRO *et al.*, 2009). The Kinesio Taping method originated from the hypothesis that an external component could aid in the functions of muscles and other tissues (KASE; WALLIS; KASE, 2003; THELEN; DAUBEN; STONEMAN, 2008; MARTINS; OLIVEIRA; LOPES, 2009). It is thin and elastic by design, which permits a stretch of 40% to 60% of its original resting size and makes it very compliant when compared to traditional taping material, therefore allowing complete range of motion (HALSETH *et al.*, 2004; OSTERHUES, 2004; BELLIA, 2006; THELEN; DAUBEN; STONEMAN, 2008; HSU *et al.*, 2009).

Various authors propose the benefits of Kinesio Taping as dependant of the stretch utilized on the tape and the form of placement on the skin, such as: positional stimulus and correction of muscle function; improvement to fascial tissue alignment; facilitation of bodily fluid circulation; repair of injured tissues; sensory stimulation to assist or limit movement, therefore improving proprioception; assistance in edema control by guiding lymph toward lymph nodes; and correction of joint position (KASE; WALLIS; KASE, 2003; KINESIO TAPING ASSOCIATION, 2005; HALSETH *et al.*, 2004; FOOTER, 2006; YASUKAWA; PATEL; SISUNG, 2006; YOSHIDA; KAHANOV, 2007; THELEN; DAUBEN; STONEMAN, 2008; MARTINS; OLIVEIRA; LOPES, 2009; RIBEIRO *et al.*, 2009, KARATAS *et al.*, 2012, BICICI; KARATAS; BALTAÇI, 2012).

According to Dr. Kase, the stretch applied to the tape inflicts tension on the

skin which improves communication with mechanoreceptors and increases the number of motor units recruited during a muscle contraction (KASE; WALLIS; KASE, 2003). In this manner, the tape can improve muscle strength and function by facilitating the contraction of weak or inactive muscles (KINESIO TAPING ASSOCIATION, 2005).

Therefore, its application over the gripping musculature of the hand could complement therapeutic treatment of manual dysfunctions once its influence has been assessed on healthy individuals. The human hand is clearly the most important and complex structure of the upper extremity due to its extensive mobility and the sensitive capabilities of its surrounding tissues, which allows for gripping and feeling as its essential functions (RIBEIRO *et al.*, 2009; DIAS *et al.*, 2010, KARATAS *et al.*, 2012).

The entire upper extremity functions with regards to the hand, and due to this intimate interdependence, any injuries along the structures of the upper extremity could compromise adequate hand function, sendo que estas lesões são as de maior incidência registradas pelo Instituto Nacional do Seguro Social (INSS) (MOREIRA *et al.*, 2001; MOREIRA; GODOY; SILVA Jr., 2001; INSS, 2009). Therefore, handgrip strength is considered to be a measurement of upper extremity integrity and is an indicator of general strength and functional capacity (RANTANEN *et al.*, 2003; IKEMOTO *et al.*, 2007).

Due to the increasing utilization of Kinesio Tape in the clinical setting, studies are necessary to confirm the proposed benefits of the method and establish evidence-based standards for this technique. In light of the scarcity of research regarding Kinesio Taping, as well as and the fundamental role of handgrip strength in human survival, this study aims at assessing the effects of Kinesio Taping on the handgrip strength of healthy women, measured by means of handgrip dynamometry.

## MATERIAL AND METHODS

This research represents an experimental, randomized, analytical, and quantitative study, in which 75 healthy women volunteered to participate. The subjects, aged between 18 and 30 years, were randomly subdivided into three groups (n=25): Kinesio, Kinesio without tension (KWT), and control. The Kinesio group underwent tape application with 25% to 35% of tension; group KWT received tape application with no longitudinal stretch added; while the control group did not receive any taping techniques. Subjects from both the Kinesio and KWT groups were unaware of the tension utilized on their respective taping techniques as to avoid possible influences on the results.

The subjects utilized in this study were physical therapy students from the institution, and were invited to participate as volunteers by means advertisements placed inside their classrooms. The inclusion criteria required a signed informed consent form and agreement to participate during all phases of the study.

Subjects were excluded from the study if they: were outside the established age range; did not return for the 24-hour and 48-hour follow-up assessment of handgrip strength; presented some limiting factor which could influence the results, such as cardiopulmonary, hormonal, or osteomyoarticular disorders; presented joint or bone deformities, congenital or acquired, in either of the upper extremities; presented central or peripheral neurological deficits; made use of anabolic substances; had suffered injuries or undergone surgeries to the upper extremities within the last six months; and had consumed alcoholic beverages or pharmaceutical substances 24 hours prior to this study.

The original project was approved by the research ethics committee of the Hospital of Tropical Diseases under protocol number 009/2011. Subjects were informed about all procedures of the study, and those interested in volunteering were asked to sign the informed consent form and received additional details of the research.

The instrument utilized to obtain handgrip strength was a JAMAR®

dynamometer, which has been validated as a gold standard tool for such purpose by the American Society of Hand Therapists (ASHT) (FESS, 1992). This method allows for simple and quick readings of handgrip strength, which is measured in kilograms/force (DURWARD; BAER; ROWER, 2001; MOREIRA *et al.*, 2003a; MOREIRA *et al.*, 2003b; DIAS *et al.*, 2010). The handle was placed on the second position for measurements (JAMAR, 2000; BOADELLA *et al.*, 2005).

Initially, the subjects were placed on an adjustable chair which was configured according to their biotype, with their backs straight, knees and hips with 90° of flexion, feet on the floor, shoulders in adduction next to the truck, elbows with 90° of flexion, forearm and wrist in neutral position, arm suspended in the air, while the examiner sustained the dynamometer for each reading, as recommended by the ASHT (JAMAR, 2000).

Standardized instructions were given to all subjects regarding the execution of the handgrip movement by means of a practical demonstration, which served as a warm-up trial with sub maximal effort. In order to avoid a competitive environment in the testing room, all subjects were assessed individually while the examiner sustained the weight of the dynamometer without offering any positive reinforcement during each trial (MOREIRA *et al.*, 2001; MOREIRA; ALVAREZ, 2002).

The subjects performed the handgrip movement with maximum effort, only during exhalation and after the verbal cue from the examiner, with the following command: “one, two, three, go”. Three repetitions were realized for each hand while alternating the tested side, starting with the right hand and then the left hand.

The resting interval between trials was 60 seconds in order to avoid muscle fatigue during the assessments. Subjects were instructed to maintain maximum contraction for 5 seconds in each trial, since research demonstrates that peak force is reached between 3 to 10 seconds of contraction (NEU *et al.*, 2002; CLERKE; CLERKE; ADAMS, 2005; LUNA-HEREDIA; MARTÍN-PEÑA; RUIZ-GALIANA, 2005; OLIVEIRA *et al.*, 2006; RUIZ-RUIZ *et al.*, 2006; BOHANNON *et al.*, 2006; GÜNTHER *et al.*, 2008;

OLIVEIRA, 2009). The average of the three trials was obtained for each hand.

In sequence, subjects from the Kinesio and KWT groups had the skin of their forearms cleaned with a cotton pad and 70% alcohol in order to apply their respective Kinesio Taping techniques. Tape placement was conducted by a single researcher certified in the Kinesio Taping method. All subjects received pink Kinesio Tex Gold tape.

The technique utilized on the Kinesio group aimed at influencing muscle function by means of activation of the flexor digitorum superficialis muscles. It was initially anchored with 2.5cm to 5cm of tape to the medial epicondyle, followed by 25% to 35% of tension as it was pulled over the targeted muscle toward the hand. The KWT group received the same tape application, with the exception that no tension was added as the tape was placed (0% of stretch). The control group only performed the handgrip strength assessment and did not receive any taping techniques (KINESIO TAPING ASSOCIATION, 2005).

The handgrip dynamometry was reassessed for all groups after 30 minutes, 24 hours, and 48 hours of taping. The subjects did not exercise their gripping muscles during the 48 hours of this study.

In order to improve standardization of the collected data, a pilot study (n=10) was previously conducted so as to allow for any necessary adjustments to data collection, which was not deemed necessary. However, the data from the pilot trial was not utilized in the present study.

The statistical analysis of data was performed with parametric tests. The variables were normally distributed, and the Statistical Package for the Social Science software (version 15.0) was utilized. Initially, a descriptive analysis of the data was conducted in order to obtain the mean, standard deviations, minimums, and maximums of the utilized items. The ANOVA test (complemented by the Student's T-test) was applied afterward in order to verify the effects of Kinesio Taping in handgrip strength after 30 minutes, 24 hours, and 48 hours, and compare them with each other. A significant alpha level of 5% was established for this study.

## RESULTS

The initial sample size totaled 83 subjects, with an average age of 21.5 years (SD  $\pm$  2.60). None of the subjects complained of pain or discomfort during the study, but according to the exclusion criteria, 8 subjects did not participated in the study's entirety (did not return after 24 and 48 hours for reassessment of handgrip strength, or presented limiting factors which could interfere with the results), therefore reducing the sample size to 75 healthy women.

Regarding the behavior of handgrip strength values, it was observed that only the Kinesio group presented increase in the average values of each of the reassessment time periods.

It was also observed that a significant increase in strength values occurred for the right hand when comparing the initial values with those obtained after 24 hours and 48 hours of tape application. For the left hand, an increase in values was observed when comparing pre-taping data with 30 minutes 24 hours, and 48 hours after the taping application. Other comparisons between the different application times did not reveal significant changes in handgrip strength (Table 1).

Table 1: ANOVA test results (complemented by the Student's T-Test) regarding the duration of Kinesio Tape use on handgrip strength.

	Pre-Taping x 30min	Pre-Taping x 48h	Pre- Taping x 24h	30min x 24h	30min x 48h	24h x 48h
Right Hand	0.0575	0.0128*	0.0188*	0.5589	0.6582	<b>0.8779</b>
Left Hand	<b>0.0211*</b>	<b>0.0113*</b>	<b>0.0110*</b>	<b>0.8169</b>	<b>0.8054</b>	<b>0.9879</b>

\* Statistically significant value ( $p < 0.005$ ).

After analyzing the data regarding duration of tape usage and the different handgrip assessment periods between groups, no significant findings were observed between the control and KWT groups. When the group that received Kinesio Taping was compared to the control group at the different assessment times, significant differences were identified for the right hand after 24 and 48 hours, and also after 48 hours for the left hand. For the comparison between the Kinesio and KWT groups during the different handgrip assessment times, the statistical test demonstrated significant increase for the right hand after 24 hours (Table 2).

Table 2: Results for the ANOVA test for the comparison between groups

	Moment of Assessment	Kinesio and Control	Kinesio and KTW
Right Hand,	Pre-Taping	0.6502	<b>0.6502</b>
	30 minutes later	0.0802	<b>0.0802</b>
	24 hours later	0.0120*	<b>0.0346*</b>
	48 hours later	0.0047*	<b>0.1519</b>
Left Hand	Pre-Taping	<b>0.1752</b>	<b>0.1752</b>
	30 minutes later	<b>0.1427</b>	<b>0.1427</b>
	24 hours later	<b>0.0578</b>	<b>0.0578</b>
	48 hours later	<b>0.0106*</b>	<b>0.2820</b>

\*Statistically significant value ( $p < 0,005$ )

For comparison of handgrip strength between the dominant and non-dominant hands, it was observed that the dominant hand demonstrated greater handgrip strength during all assessment times, when considering the average dynamometry value, especially in the Kinesio and control groups (Table 3).

Table 3: The dominant hand presented greater handgrip strength (in percentage).

	Kinesio Group	Group K.T.W	Control Group
Yes	76%	52%	68%
No	24%	48%	32%

## DISCUSSION AND CONCLUSION

Research regarding Kinesio Taping is still scarce in the scientific literature since the technique has only received international attention within the last ten years. Moreover, the available studies are deprived of large, homogeneous samples and are conducted with questionable methodologies. It should be noted that the present study is the first to utilize the most significant sample size in order to assess the effects of Kinesio Taping on muscle strength.

The primary objective of this study was to observe the influence of Kinesio Taping on handgrip strength by comparing the dynamometry averages prior to tape application with values from 30 minutes, 24 hours, and 48 hours of tape usage. The results demonstrate significant statistical difference after 24 hours and 48 hours for the right hand, and after the three post-taping assessments for the left hand. The results for the right hand after 30 minutes of taping revealed a p-value of 0.0575, which would have achieved significant difference with a p-value less than 0.05 (since the significant level utilized in this study was 5%). Therefore, it did display an increase in handgrip strength after 30 minutes, and it came very close to the established significance level. These findings were not observed with the KWT and control groups, thus confirming the hypothesis of this study, in which Kinesio Taping can increase handgrip strength when applied with the systematic standards for such purpose.

According to Dr. Kenzo Kase, the Kinesio Taping method can improve strength of weakened or inactive muscles by correcting its function with stimuli and reinforcement (KINESIO TAPING ASSOCIATION, 2005). These results are similar to

those found by Vithoulka *et al.* (2010), in which Kinesio Taping was able to increase eccentric muscle strength in healthy adults. According to these authors, when applied from the muscle's origin to its insertion, the tape generated traction in the same direction of the contraction, therefore increasing basal muscle tone and improving strength (VITHOULKA *et al.*, 2010).

Yi-Ju (2009) observed the effects of Kinesio Taping on knee musculature strength of 11 healthy individuals (7 men and 4 women). The technique was applied in order to increase muscle activation of both knees, and strength assessment was conducted with an isokinetic dynamometer prior to taping and 72 hours afterward.

Contrarily to these results, Chang *et al.* (2010) evaluated the influence of Kinesio Taping on the maximum handgrip strength of 21 healthy students, all of them men and athletes of the respective institution. The technique employed was specifically for medial epicondylitis, and no significant changes in strength were observed after taping. However, an incoherent factor of this study was related to the tension applied to the placebo group, which was the same as the Kinesio group (between 15% and 20%). Even with technique starting more distally than the insertion point, the tension zone remains the same, thus making the purpose of such a comparison between these two groups questionable.

Divergences are also seen in the results presented by Fu *et al.* (2008), in which Kinesio Taping was applied with 120% of longitudinal stretch over the quadriceps and hamstring muscles of 14 healthy athletes (7 men and 7 women), and assessed in the following manner: before tape application, immediately after taping, and 12 hours afterward. An isokinetic dynamometer was utilized in order to verify these muscle groups, and no significant increase was found in muscle strength of these athletes. In fact, a decrease in strength was actually observed. The greatest incoherence found in this study is in the actual tension applied to the tape, which was 120%, and should only be utilized for taping procedures of a ligamentous injury. Such a high tension may hinder muscle contraction and decrease in joint mobility, which could consequently lead to a non-functional movement and muscle inactivation.

Some authors observed an increase in electromyographic activity with the use of Kinesio Tape, such as Murray (2003), Slupik *et al.* (2007), Chen *et al.* (2007), Hsu *et al.* (2009), and Thelen, Dauben and Stoneman (2008). In all of these studies, an improvement in electromyographic signals was seen.

In the aforementioned studies, the randomness related to the assessment of Kinesio Taping is notorious, as seen by the lack of a systematic approach in relation to data collection, which does not permit a reliable assessment of initial benefits, the duration of benefits with taping, and if there are any lingering effects after its removal. Some authors evaluated the influence of Kinesio Taping immediately after its application (Hsu *et al.*, 2009; Chang *et al.*, 2010), other assessed it immediately afterward and 12 hours later (Fu *et al.*, 2008), as well as 24 hours and 72 hours later (Slupik *et al.*, 2007), and only after 72 hours of taping (Yi-Ju, 2009; Vithoulka *et al.*, 2010).

With regards to the stretch applied to the tape, some authors do not specify how much was utilized in their respective studies (Chen *et al.*, 2007; Hsu *et al.*, 2009). Other studies simply do not follow the standards recommended by the Kinesio Taping Association (2005). An example of this is related to the tension for muscle activation, which has been established to be between 25% and 35%, but some authors opted to utilize 15% to 20% of tension (Chang *et al.*, 2010) or even 120% (Fu *et al.*, 2008).

The majority of studies found in the literature do not specify the brand of the tapes utilized in their research, for differences in tape quality could consequently influence the results obtained with their applications. The Kinesio Taping Association International (2005) only recognizes research conducted with the Kinesio Taping method which utilized Kinesio Tex Gold tape. In this manner, among the previously cited studies, only three revealed the brand of the tape utilized, being them Kinesio Tex Tape (Fu *et al.*, 2008; Chang *et al.*, 2010) and Kinesio Tex (Hsu *et al.*, 2009).

According to Espejo and Apolo (2011), such heterogeneity in research methodologies hampers the discussion of studies which address the effects of Kinesio

Tape.

When comparing the Kinesio and control groups of the present study, the greatest handgrip strength values were observed in the Kinesio group 24 hours and 48 hours after application of the taping technique to the right hand, and after 48 hours for the left hand. These results indicate that handgrip strength increased and maintained elevated for the right hand during 48 hours. For the left hand, however, this increase was only observed after 48 hours of taping.

One possible explanation for this is the fact that, even for left-handed subjects, the right hand frequently participates in the realization of activities of daily living, which makes it more sensitive to mechanoreceptor stimuli provided by the contact of the taping technique with the skin (HANTEN *et al.*, 1999; MOREIRA; GODOY; SILVA Jr., 2001; INCEL *et al.*, 2002).

In order to explain this differentiated mechanoreceptors stimuli in the dominant extremity, Adam, De Lucca, and Erim (1998) analyzed the muscle recruitment threshold of motor units in the dominant and non-dominant hand by means of electromyography in 8 male subjects. They concluded that motor units of the dominant hand are recruited more quickly and with a lesser activation threshold. For them, the preferential use of the dominant hand alters the mechanical properties of the muscles, leading to their hypertrophy and an increase in their cross-sectional area.

The study by Friedli, Fuhr, and Wiget (1987) sought to evaluate the relationship between sensory threshold and side of dominance. They selected 119 healthy subjects and assessed sensitivity of both hands by using a percutaneous electrical stimulus on the distal phalange of the fifth finger. They observed that 73.5% of right-handed subjects had decreased sensitivity on the left hand, and 70.8% of left-handed subjects had decreased sensitivity on the right hand.

Considering that changes in handgrip strength were observed after 24 hours for the right hand, which lasted up to 48 hours, and that such changes were noted only after 48 hours for the left hand, it is believed that the sensitivity of the right hand is

greater than the left hand. Therefore, the mechanoreceptor stimulus induced by the Kinesio Taping provided a faster response on the right hand than its counterpart. The left hand possibly required greater tension and a longer period of time for it to receive enough stimulation and achieve the same results as the right hand.

With regards to the augmented handgrip strength observed for the right hand of the Kinesio group in relation to KWT group 24 hours after taping, it is assumed that the tactile stimulus to the dermis and epidermis are present even in the application without tension, since the skin maintains its normal mobility by stretching and recoiling in relation to the tape during upper extremity movements.

Another result noted was that the dominant hand presented greater handgrip strength when considering the average values during each of the four assessment moments, namely, before Kinesio Taping application, and 30 minutes, 24 hours, and 48 hours later. Such finding was observed for all groups, but with a higher percentage in the Kinesio and control groups.

This result corroborates with other studies which describe greater handgrip strength for the dominant hand (CAPORRINO *et al.*, 1999; HANTEN *et al.*, 1999; MOREIRA; GODOY; SILVA Jr., 2001; INCEL *et al.*, 2002; MOREIRA; GODOY; OLIVEIRA, 2004; ÖZCAN *et al.*, 2004; GÜNTHER *et al.*, 2008; SCHLÜSSEL; ANJOS; KAC, 2008).

It is believed that such result is due to the fact that today's society is entirely directed toward right-handed individuals, therefore causing left-handed people to adapt and utilize their non-dominant hand, which would increase the average strength values obtained for the right hand (HANTEN *et al.*, 1999; MOREIRA; GODOY; SILVA Jr., 2001; INCEL *et al.*, 2002). In light of this, these authors suggest that manual dynamometry values be expressed in terms of the right and left hand, and not by the dominant side, which corroborates with what was conducted in the present study.

Considering the obtained results, it is possible to conclude that an increase in handgrip strength occurred when comparing pre-taping values with those observed 30

minutes, 24 hours, and 48 hours after Kinesio Taping application. A statistically significant increase was observed in the Kinesio group when compared to control after 24 and 48 hours of taping for the right hand, and after 48 hours for the left hand. Between the Kinesio and KWT groups, an increase was noted 24 hours after taping for the right hand. The dominant hand presented greater handgrip strength values during all assessments between all groups. In this manner, it can be affirmed that Kinesio Taping is capable of augmenting muscle strength.

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