Original Research

Immediate Effect of Kinesiotaping on Non-dominant Wrist Extensor Muscles:an Alteration in Handgrip Strength of Healthy Individuals

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ABSTRACT

Background: Adequate function of wrist extensor muscles is essential for handgrip strength. Handgrip strength can be used as a health problem predictor in the future. Maintaining and increasing handgrip strength to reduce the risk of future mortality is noteworthy.

Aim: To investigate the immediate effect of the kinesiotaping facilitation technique on the non-dominant wrist extensor muscles on handgrip strength of healthy individuals.

Material and Methods: This study was conducted in October and November 2020. Twenty-two healthy men, aged 25 – 40 years and willing to participate in this study by signing the research agreement form was recruited from Medical Rehabilitation Departement RSUD Dr. Soetomo Surabaya, and randomized into kinesiotaping group and placebo taping group. The kinesiotaping group received kinesiotaping facilitation technique Y strip 50% stretched on the non-dominant wrist extensor muscles. The placebo taping group received non-elastic adhesive tape Y strip on the non-dominant wrist extensor muscles. Handgrip strength was measured using hydraulic handgrip dynamometer before and 30 minutes after kinesiotaping facilitation technique and placebo taping applied.

Results: Alteration of handgrip strength is significant increase in kinesiotaping group compared to placebo taping group (p=0.036).

Conclusion: Kinesiotaping facilitation technique on non-dominant wrist extensor muscles can immediately increase handgrip strength of healthy individuals.

Keywords: *Handgrip, Healthy Individuals, Human and Health, Immediate Effect, Kinesiotaping, Non-dominant, Wrist Extensor Muscles.*

Introduction

The wrist extensor muscles are the muscle group that functions to move the wrist in an extension and plays a role in the wrist stabilization process to produce strong grip strength.[1] Weakness or fatigue of the wrist extensor muscles can reduce the strength of the handgrip.[2] Handgrip strength can be used as a risk for predicting a person's future health problems, assessing disorders of the upper extremities, or developing a treatment plan.[3]

Dr. Kenzo Kase developed kinesiotaping in 1973 in Japan using a special elastic band that can be stretched longitudinally to 140% of the initial length before application to the skin. This method is rapidly developing and is used as a non-invasive treatment method to improve muscle and joint function, reduce pain, maintain normal tissue biomechanics, improve tissue hemostasis, improve circulation and lymphatic flow, reduce delayed onset muscle soreness.[4–6]

Several studies have shown different effects in handgrip strength after kinesiotaping application to the wrist.[7,8] In their quantitative study, Lemos and colleagues (2015) found an increase in handgrip strength after 30 minutes, 24 hours, and 48 hours by facilitating the flexor digitorum superficialis muscle through the application of kinesiotaping with 25% to 35% tensile taping. Kim and Kim (2016) also showed an increase in the handgrip strength after using kinesiotaping with a taping stretch of 50% on the dominant wrist extensor muscles specified using the Edinburg Handedness Inventory. Chang et al (2010) assessed the strength of the handgrip in 21 healthy athletes divided into groups without taping, placebo taping, and kinesiotaping. The study provided a Y strip kinesiotaping inhibition technique with a 15-20% stretch in the flexor muscles of the dominant wrist. Handgrip strength immediately after treatment in the three study groups did not differ significantly.

The results of previous studies indicate that the effects of kinesiotaping are still controversial both in increasing the strength of the handgrip and the duration required to cause a strength enhancing effect. This study aims to assess the immediate effect of the application of the facilitation technique kinesiotaping on non-dominant wrist extensor muscles on the handgrip strength of healthy individuals.

Material and Methods

Study design and subjects

We conducted a randomized pre and post-test study in October and November 2020 at the Outpatient Rehabilitation Clinic of Dr. Soetomo General Academic Hospital Surabaya, East Java, Indonesia. The total subjects of 22 healthy men were recruited from the Outpatient Rehabilitation Clinic of Dr. Soetomo General Academic Hospital. The inclusion criteria were healthy men, aged 25-45 years old, and willing to participate in this study by signing the research agreement form. The exclusion criteria were history of non-dominant upper limb injury and history of medial and lateral epicondylitis within 6 months prior to the study, history of allergy to tape, deep vein thrombosis, joint and bone deformity on non-dominant wrist, peripheral or central neurology deficit, consuming anticoagulant. Drop out criteria if subject unwilling to continue the study, unable to complete handgrip measurement according to the protocol, joint or muscle pain when active movement or inflammation signs appeared suddenly during the study, subject complain chest pain and dyspnea during study.

Protocols

In the beginning, the vital signs and physical examinations were performed. Research detail and procedure were informed to all subjects and provided signed, informed consent before the study. Non-dominant hand were determined using the *Edinburg Handedness Inventory-Short Form*.[9] Subjects were randomly assigned to the kinesiotaping (n=11) and placebo taping group (n=11). Non-dominant handgrip strength were measured while sitting on a chair without leaning, slight shoulder abduction (15^o), elbow flexion (90^o), forearms mid supination pronation, wrist extension ($30\text{-}35^o$).[3] For the baseline handgrip strength, subjects were asked to

grip the handle of dynamometer with maximal effort for 3 s with one-minute rest between trials, the values of the 3 trials were recorded and averaged. All subjects were asked to performed elbow extension and wrist flexion and the length of the tape was measured based on protocol by Tinduh.[10] Subjects in kinesiotaping group received Y strip kinesio tape facilitation technique 50% stretched on non-dominant wrist extensor muscles. The proximal head of kinesiotape were applied over the lateral epicondyle, the tail was along the ulnar and radial side of wrist extensor to dorsal wrist. The skin of participants was cleaned with alcohol and required to keep the wrist in full flexion position with elbow in full extension and pronation while the kinesiotape being applied. Subjects in the placebo taping group received non-elastic adhesive tape Y strip without stretched on non-dominant wrist extensor muscles in the same manner with kinesiotape group.[3,11] Handgrip strength reevaluated 30 minutes after intervention for each group.

The study protocol was approved by The Ethics Committee of Dr. Soetomo General Academic Hospital Surabaya, East Java, Indonesia (0082/KEPK/X/2020).

Statistical Analysis

The normal distribution of all variables was tested with Shapiro-Wilk test. Normally distributed data were age, and handgrip strength before intervention. Parametric t-test to was used to compare both two groups. Statistically significant in differences if *p*-value < 0.05. All data were analyzed using SPSS.

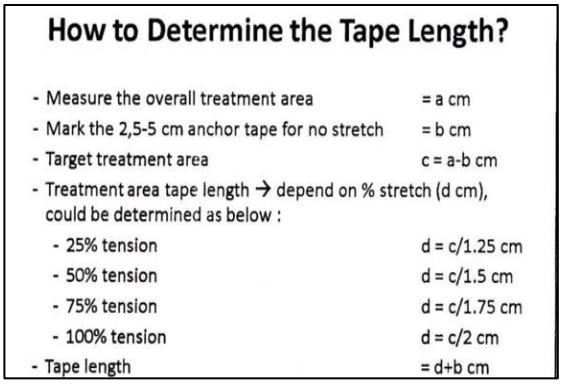

Image 1. How to determine the tape length

Results

The study protocol was completed by all 22 subjects with no dropout throughout the study. No adverse effect was reported during or after the program. The homogeneity test of subject characteristics include age and handgrip strength before intervention between two groups were not significantly different ($p > 0.05$), (Table 2). The results of this study indicate a trend of increasing handgrip strength in the kinesiotaping group, $p = 0.058$ (Table 3). Alteration of handgrip strength is significant in kinesiotaping group compared to placebo taping group (p = 0.036) (Table 4).

Table 2. Clinical characteristic of subjects at baseline

Characteristic	Study Group		p
	Kinesiotaping (n=11)	Placebo taping (n=11)	
Age (years)	32.81±3.76	32.18±3.68	0.693[a]
Non-dominant hand (%)			0.038[b]
Right	0 (0%)	1(9.1%)	
Left	11(100%)	10 (90.90%)	
Handgrip strength (kg)	33.54±5.084	33.02±5.146	0.817[a]

Data are presented as the mean ± standard deviations (SD) or percentage (%).
[a] = Independent *t*-test; [b] = Levene's Test. *significant if $p < 0.05$.

Table 3. Mean handgrip strength baseline and after intervension (kg) both groups

Study Group	Baseline (Mean±SD)	After intervension (Mean±SD)	p
Kinesiotaping	33.54±5.084	35.04±5.40	0.058
Placebo taping	33.02±5.146	32.78±4.941	0.299

Paired T-test. *significant if $p < 0.05$.

Table 4. Comparisons of delta handgrip strength between the Kinesiotaping and Placebo taping group

Delta handgrip strength (kg)	(Mean±SD)	p
Kinesiotaping	1.509±2.340	0.036*
Placebo taping	0.241±0.732	

***** Independent *t*-test; Significant: $p < 0.05$

Discussions

This study showed significant increase in non-dominant handgrip strength 30 minutes after application of kinesiotaping facilitation technique compared to placebo taping. Lemos et al (2015) also obtained increased handgrip strength at 30 minutes, 24 hours and 48 hours after kinesiotaping application on wrist flexor muscles compared to the control group. Another study by Kim and Kim (2016) compared the handgrip strength of dominant hand immediately after kinesiotaping application and non-elastic tape to 20 healthy men who were divided into 2 groups. The study used the kinesiotaping I strip facilitation technique with 50% stretch and non-elastic tape which was applied to the wrist extensor muscles. There was no significant difference in the increase in handgrip strength between groups, but the handgrip strength in the kinesiotaping group increased significantly compared to the initial value, while the non-elastic tape group did not increase significantly.

Kinesiotaping facilitation techniques on muscle activity are thought to increase the stimulated muscle contraction reflex and the inhibitory reflex of antagonistic muscles via stimulation of cutaneous mechanoreceptors. Simultaneously with these conditions, motor control and coordination of the wrist joint will increase, which will lead to optimal muscle contraction.[12] Another mechanism that allows for an increase in muscle strength after the application of the facilitation technique kinesiotaping is modification of muscle length. Kinesiotaping facilitation technique will pull the skin, lift the fascia and connective tissue to provide space so that the muscles are pulled toward the contraction. The muscle tone is increased and the muscles are maintained in a shortened position, this will lead to optimization of the actin-myosin overlap and ultimately increase strength production.[3,12] In addition, kinesiotaping is also thought to provide a constant stimulus to cutaneous afferents which increases the excitability of the motor cortex, thereby facilitating the recruitment of motor unit muscles. This condition will ultimately help the muscle's ability to produce a more optimal contraction force.[3,13] The wrist extensor muscles will improve grip stability, exert compressive force on the metacarpophalangeal joints and wrists, balance the forces on the flexor muscles and cause stronger contraction of the finger flexors by maintaining a length-tension relationship.[14]

Handgrip strength in this study was re-evaluated 30 minutes after kinesiotaping application and gave a significant improvement compared to the placebo taping group. Research conducted by Lemos et al (2015) also found an increase in handgrip strength at 30 minutes after kinesiotaping application. However, these results contradict with study by Cai et al which assesses the handgrip strength immediately after kinesiotaping facilitation technique on dominant wrist extensor compared to kinesiotaping inhibition technique and without kinesiotaping.[15] The Y strip kinesiotaping facilitation technique on the wrist extensor muscles used in this study provided sufficient stimulation to increase the strength of the handgrip. This is in accordance with the recommendations of Wirawan et al for the facilitation of weak muscles.[16] The technique used in this study is also in accordance with the recommendations of Wirawan et al and Kase et al, namely using the facilitation technique with the pulling direction of the tape from origo to muscle insertion with a stretch of 25-50% to increase weak muscle

strength.

The application of kinesiotaping facilitation technique will give the effect of increasing the strength of the weak muscles.[4] The dominant hand can be 30% stronger than the non-dominant hand, with the most common difference being 5-10% stronger than the non-dominant hand.[17] The result obtained from this study is contradictory with study by Kuo and Huang (2013). The effect of the kinesiotaping facilitation technique on the dominant and non-dominant hand is still controversial

The placebo taping group in this study did not get a significant alteration after intervention. This also happened to research conducted by Donec et al.[18] The results obtained by the placebo taping group could be due to the different materials, properties and techniques of applying non-elastic medical tape to kinesiotaping so that the effect obtained was not the same as kinesiotaping.

This study evaluated the immediate effect, 30 minutes after application. Further evaluation still needed to know the alteration from longer duration of kinesiotaping application on handgrip strength.

Conclusions

Kinesiotaping facilitation technique Y strip with 50% stretch improve handgrip strength in healthy individuals.

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