

Immediate and short-term effects of 35% tension Kinesio taping on handgrip strength in healthy females

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Abstract

Introduction. Kinesio taping is one of the commonly used treatment modalities in rehabilitation. When applied appropriately, it may improve muscle strength and performance. This study aimed to determine the immediate and short-term effect of 35% tension Kinesio taping on handgrip strength in healthy females.

Methods. Overall, 60 healthy female subjects aged 19–30 years were randomly assigned to 2 groups: the tension Kinesio taping group, who received taping with 35% tension, and the control group, who received the same taping technique but with no tension. A hand-held dynamometer was used to measure handgrip strength in all participants. The measurements were taken before taping, as well as at 30 minutes and 24 and 48 hours of taping.

Results. Handgrip strength significantly improved in both groups after taping ($p < 0.05$). Comparing with the control group, the tension Kinesio taping group demonstrated more significant results at 30 minutes and 24 and 48 hours ($p < 0.05$).

Conclusions. Taping with 35% tension produces an immediate and short-term increase in handgrip strength in healthy females.

Key words: athletic tape, hand strength, healthy volunteers, females

Introduction

Kinesio taping (KT) has become one of the commonly used treatment modalities in the recent years. This treatment method is relatively new: Kenzo Kase first created it in 1973 [1]. Owing to its flexibility, the use of KT has no adverse effects on joint range of motion. The adhesive surface of KT is characterized by a wave-like grain design, which provides a considerable amount of elasticity [2].

Recently, KT has been used in a variety of fields with different goals: alleviating pain [3], augmenting joint range of motion [4], correcting fascial mechanics [5], stimulating the sensory system, improving circulation [6], and enhancing muscle performance [7].

The strength of the handgrip muscles is one of the key factors determining muscle performance, which must be assured during any rehabilitation program for the upper extremities [8]. Loss of strength prevents the subject from performing necessary daily activities and occupational tasks [9, 10].

Improving handgrip strength via a simple, applicable, and easy method such as KT is a significant concern in rehabilitation [11]. It can lead to recovery in musculoskeletal injuries and neuromuscular re-education [12, 13]. KT has gained acceptance among rehabilitation and sports professionals as an effective technique for different conditions [14].

The literature shows a lack of consistency regarding the amount of tension required to produce the appropriate handgrip strength. To enhance muscle power, Kenzo Kase sug-

gested taping with 25–35% tension [15]. However, other researchers recommended 50% tension, while Atrib Zanchet et al. [16] demonstrated that KT with 25% tension did not demonstrate any changes in the handgrip strength.

Limmer et al. [17] reported that KT over the wrist flexors and extensors might not improve muscle strength; however, it could prevent muscle fatigue during muscle endurance performance tasks in tennis players.

In terms of timing, a previous study stated that the most significant effect of taping as measured by percent changes in handgrip power appeared after 30 minutes in men and 90 minutes in women [7]. Another study compared different durations of KT on the handgrip and pinch grip strengths: the evaluations were performed immediately, as well as 24 and 48 hours after the tape application. The results revealed that the desired effects occurred after 48 hours of application [18]. Another study evaluated knee extensor torque after 24 hours of KT application, demonstrating that 1 day of KT application was insufficient to induce a measurable change in quadriceps strength [19].

In light of the previously described controversies – and the popularity of using KT in the rehabilitation of hand injuries – well designed studies on the efficacy of different tensions applied with taping techniques are needed. Thus, this study aimed to investigate (1) the effect of KT with 35% tension, (2) the influence of KT duration on handgrip strength in healthy subjects.

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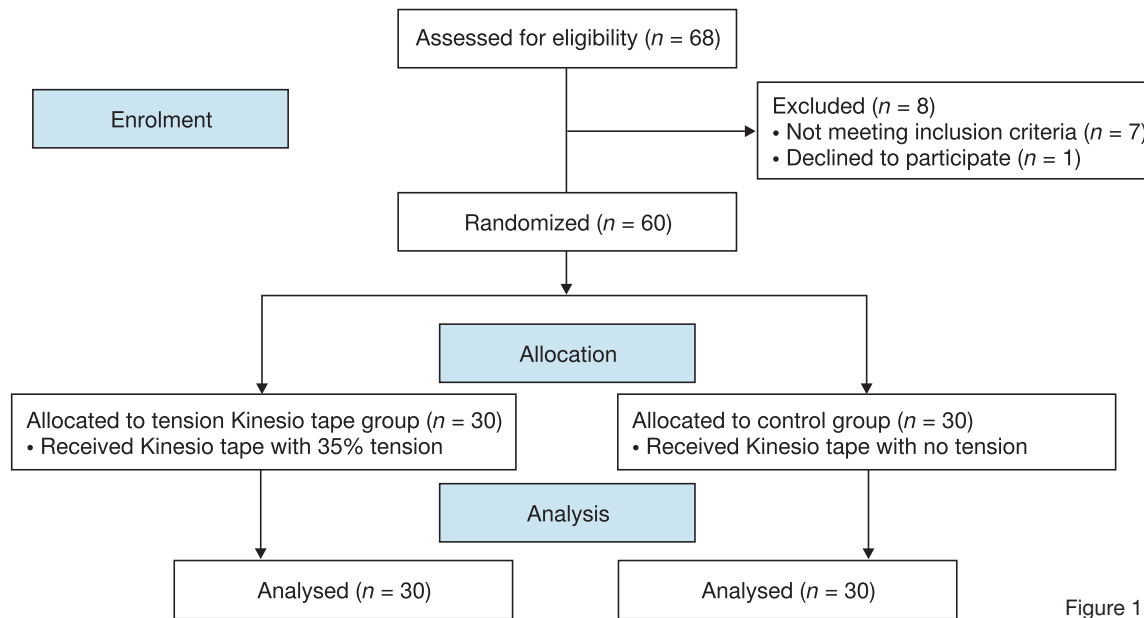


Figure 1. Flow chart

Subjects and methods

Design

This randomized double-blind controlled clinical trial was conducted between January and June 2019.

Participants

Overall, 60 healthy female participants were recruited from the local community with verbal and written announcement. Included were healthy females aged 19–30 years. Subjects were excluded if they (1) had a localized or systemic disease or injury affecting the function of the upper extremities, (2) were athletes, and (3) received analgesic or muscle relaxant medications (Figure 1).

Randomization

The participants received clear instructions about the purposes and procedures of the study, as well as detailed explanation of their rights. They were allocated into 2 equal groups with the use of permuted blocks. The randomization was performed by the third author, who was not involved in either the assessment or treatment.

Intervention

The first group, the tension Kinesio taping (tKT) group, received KT with 35% tension over the extensor surface of

the forearm. The second group was a control group and received the same taping technique but with no tension.

An experienced therapist (the fourth author) applied the tape to the participants in both groups. The tKT group subjects received I-shaped taping, in accordance with the guidelines stated by Mohammadi et al. [7] and adopted recently by Kim and Kim [1]. The extensor surface of the dominant forearm was cleaned with an alcohol cotton swap before applying the tape. The therapist instructed the participants to sit on a chair with a straight back, assuming the upright position and resting her feet on the ground. The examined arm was held against the body, with the elbow joint kept at 90°, the forearm pronated, and the wrist joint in the neutral position.

For the tKT group, the length of the tape was determined as the distance between the point located 2 cm distally to the lateral epicondyle of the humerus and the radial styloid process. The tape ends (anchors) were 4 cm (2 in each end). The 35% tension was calculated with the following formula:

$$(L - 4 / 1.35) + 4$$

where L is the tape length, 4 represents the length of the anchors, and 1.35 depicts the required tension [20].

The control group received taping with no tension, applied between the previously mentioned points (Figure 2). The taping was administered from proximal to distal. The participants were instructed to leave the tape in place for the entire period of the study (48 hours).



Figure 2. Application of Kinesio taping on the dorsal surface of forearm

Outcome measure

The assessor (the second author) measured the strength of the handgrip using a recently calibrated Lafayette push hand-held dynamometer (model 01163, Lafayette Instrument Co., Lafayette, IN, USA). The dynamometer has a dual pointer system to retain the maximum effort. The testing range is on a dual scale of 0–100 kG. The device is a valid and reliable tool for assessing isometric hand muscle strength [21].

The participants were instructed to sit on a chair with arm-rests. The shoulder was slightly abducted, the elbow was at a right angle, and the forearm was in the mid-supination/pronation position. The subjects were asked to squeeze the handle of the dynamometer using maximum effort for 3 seconds and then relax for 1 minute. This measurement was repeated 3 times, and the average of the 3 readings was considered the baseline record for maximum grip strength. The testing procedure was performed with the dominant hand before taping and repeated after 30 minutes and 24 and 48 hours of taping.

Sample size calculation

The sample size was estimated on the basis of the expected effect size ($d = 0.3$) with 80% power and a probability of 0.05. The analysis indicated a total sample size of 58 participants (29 per group); however, we recruited 60 participants in anticipation of dropout.

Statistical analysis

The statistical analyses used the IBM Statistical Package for the Social Sciences (SPSS) software, version 23 (Chicago, USA). All data were expressed as mean \pm standard deviation. They were normally distributed, which was verified with the Shapiro-Wilk test. An unpaired t -test was applied to determine any changes between the 2 groups regarding the demographic characteristics and handgrip strength. Repeated measure analysis of variance (ANOVA) evaluated within-subject changes in handgrip strength at different measurement

time points in both groups. The Bonferroni post-hoc test implied where changes occurred across different time measurements. Statistical significance was defined as 5%.

Ethical approval

The research related to human use has complied with all the relevant national regulations and institutional policies, has followed the tenets of the Declaration of Helsinki, and has been approved by the ethical committee of College of Applied Medical Sciences, the University of Hail (No. PT:47/2020).

Informed consent

Informed consent has been obtained from all individuals included in this study.

Results

There were no significant differences in terms of age, height, weight, or body mass index between the 2 groups (Table 1). The comparison of handgrip strength scores between the 2 groups revealed that the tKT group presented significantly improved handgrip strength after 30 minutes and 24 and 48 hours ($p = 0.02$, $p = 0.000$, and $p = 0.000$, respectively) vs. the control group (Table 2).

The within-subject results in the tKT group showed a significant increase in handgrip strength compared with baseline (Wilks' lambda = 0.11, $F(3, 27) = 74.13$, $p < 0.05$, $\eta^2 = 0.89$), as illustrated in Table 2. However, the Bonferroni post-hoc test revealed no significant improvements in handgrip strength when comparing 24 with 48 hours of taping ($p = 1$) (Figure 3).

Regarding the control group, taping without tension demonstrated a significant increase in the handgrip strength when compared with baseline (Wilks' lambda = 0.39, $F(3, 27) = 13.96$, $p < 0.05$, $\eta^2 = 0.60$). This improvement was evident at 30 minutes and 24 and 48 hours of taping. However, the Bonferroni post-hoc test reported no significant differences in handgrip strength between 30 minutes and 24 and 48 hours of taping ($p > 0.05$).

Table 1. Demographic characteristics of participants

Variables	Tension Kinesio taping group (n = 30) (mean \pm SD)	Control group (n = 30) (mean \pm SD)	p
Age (years)	25.9 \pm 3.34	26.46 \pm 2.16	0.44
Weight (kg)	59.26 \pm 9.86	55.8 \pm 8.05	0.518
Height (cm)	157.8 \pm 5.50	159.3 \pm 3.98	0.240
Body mass index	23.87 \pm 4.40	21.97 \pm 3.17	0.161

Table 2. Changes in handgrip strength (kG) between groups at baseline and after 30 minutes and 24 and 48 hours

Time of measurement	Tension Kinesio taping group (n = 30) (mean \pm SD)	Control group (n = 30) (mean \pm SD)	p
Baseline	16.96 \pm 4.19	16.13 \pm 4.19	0.45
After 30 minutes	19.36 \pm 3.96*	16.93 \pm 3.93*	0.02
After 24 hours	21.9 \pm 3.66*	17.36 \pm 3.63*	0.000
After 48 hours	22.1 \pm 3.78*	17.23 \pm 3.55*	0.000

* significant when compared with baseline

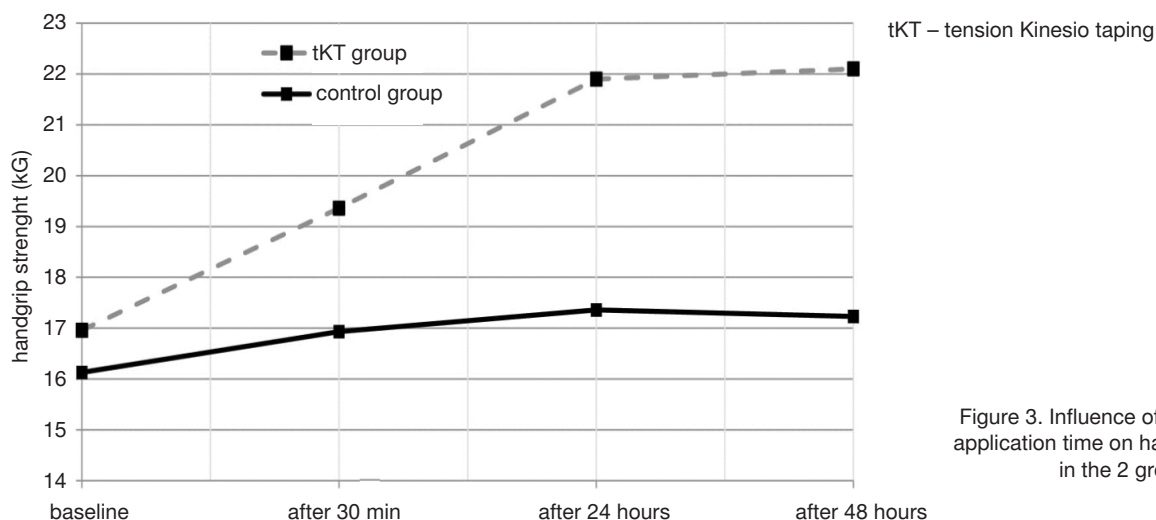


Figure 3. Influence of Kinesio taping application time on handgrip strength in the 2 groups

Discussion

The purpose of this study was to assess the immediate and short-term effect of KT with 35% tension on handgrip strength. The results demonstrated a significant increase in the strength of the handgrip when 35% tension was used; this significant effect was observed at 30 minutes and 24 and 48 hours of taping.

Regarding the tKT group, the handgrip strength reached its peak value at 24 hours and then plateaued from 24 to 48 hours. Meanwhile, the handgrip strength in the control group reached the peak at 24 hours, then started to decline, and reached borderline statistical significance at 48 hours of taping ($p = 0.047$).

The current results agree with those demonstrated by Vilela Lemos et al. [15]. These authors concluded that taping with 35% tension could effectively increase the handgrip strength in normal subjects.

In contrast to our findings, Merino-Marban et al. [22] reported no changes in handgrip strength after using 30% tension taping. In that study, the tape was applied to the flexor surface of the forearm.

In other research, taping with 50% tension demonstrated favourable results [1, 7], with an immediate improvement in a study conducted by Kim and Kim [1]. Unfortunately, the sample in that study was small and the gender was not specified. Mohammadi et al. [7] reported similar results after 50% tension taping. Moreover, they noticed that the onset of the taping effects was relatively slower in women than men. In the current study, both groups reached peak grip strength after 24 hours of taping.

Taping pulls the skin upward when applied with tension, and thus more space is provided for contraction by lifting the soft tissues [23]. Additionally, the connections that may exist between the skin and proprioceptors might increase the number of motor unit recruitments after cutaneous stimulation by the tension of taping [15]. This recruitment hypothesis is supported by the increased electrical activity inside the muscle observed after taping the related cutaneous tissue [24–26].

Taping without tension can evoke a placebo effect and produce changes in muscle strength [27]. This effect was short-lasting as it declined after 24 hours of taping, as shown in the current study. Another explanation for the improvement reported in the control group is that KT produces cutaneous stimulation that could affect the muscle spindle ac-

tivity and increase the strength of the handgrip even without tension.

Limitations

The current study has 2 limitations: it did not consider the difference in taping response that may be found between males and females, and it did not investigate the intermediate effect. Consequently, future studies should take into account both gender differences and the intermediate effect of taping.

Conclusions

Both KT with 35% tension and with no tension can produce an immediate and short-term increase in handgrip strength. However, 35% tension taping resulted in higher strength that persisted for a longer time.

Disclosure statement

No author has any financial interest or received any financial benefit from this research.

Conflict of interest

The authors state no conflict of interest.

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