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Original Research Article

The effect of Kinesio Taping on maximal grip force and key pinch force

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ABSTRACT

Introduction: Kinesio Taping method is used to achieve various therapeutic effects such as circulation improvement, subcutaneous lymphatic drainage, muscle facilitation or inhibition, fascia correction, and mechanical correction. According to its founder, the effects of KinesioTex tape on the body will differ depending on how and where such tape is placed.
Aim: To evaluate whether Kinesio Taping can increase maximal grip force and maximal key pinch force for healthy non-athletic subjects after 30 min and 1 h following the application.
Materials and methods: In total, 54 healthy subjects participated in this study. Both hands were used in the research. Special Kinesio Taping technique was applied to 32 hands (Kinesio Taping group), and placebo taping to 22 hands (placebo group); no taping technique was applied to 54 hands (control group). A dynamometer was employed for grip force, and a manometer for key pinch force measurements. The chosen level of significance was $p<0.05$. The power of the study was calculated. In the case of $\beta \leq 0.2$, the difference was statistically significant.
Results and discussion: In the Kinesio Taping group no changes in maximal key pinch force after 30 min were observed; however, 1 h following the application maximal key pinch force increased ($p<0.05$, $\beta=0.3$); maximal grip force increased both after 30 min ($p<0.05$, $\beta=0.2$) and 1 h following the application ($p<0.05$, $\beta<0.2$). No changes in the measured forces were observed in the placebo and control groups ($p>0.05$).
Conclusions: The Kinesio Taping technique did not result in changes to maximal key pinch force after 30 min, but increased maximal key pinch force after 1 h and maximal grip force after 30 min and 1 h following such application.

1. Introduction

Kinesio Taping method as a new taping technique was developed by Japanese Dr. Kenso Kase in 1973. This method differs from other taping techniques because of the specially designed elastic tape – KinesioTex Gold – which is used and applied directly on the skin in a special manner in order to achieve various therapeutic effects, such as circulation improvement, subcutaneous lymphatic drainage, muscle facilitation or inhibition, fascia correction, and mechanical correction. According to its founder, the effects of KinesioTex tape on the body will differ depending on how and where such tape is placed.

Dr. Kenso Kase suggests two basic application directions for the treatment of muscles. For acutely over-used or stretched

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muscles, the tape is applied from muscle insertion to origin to inhibit muscle function. For chronically weak muscles or where an increased contraction is desired, the tape is applied from origin to insertion to facilitate muscle function. A proper tape application for muscle facilitation occurs when light ("paper off") to moderate tension is used, i.e., 25–50% of the available tension. Another type of Kinesio Taping application (where maximal tape tension is used) is called functional correction. This type is used to increase sensory stimulation to either assist or limit motion.[6]

Evidence concerning the effects of Kinesio Taping on muscle strength has been limited thus far. Some studies have shown a significantly increased recruitment of motor units and an increased bioelectrical activity following application;[2,4,8] however, Fu et al. in their pilot study found no significant difference in quadriceps isokinetic muscle strength either immediately following the tape application or after 12 h of taping.[3] Hsiao-Yun Chang et al. tried to determine the immediate effects on maximal grip strength and force sense in healthy collegiate athletes after the application of Kinesio Taping to the forearm. They also concluded that Kinesio Taping did not result in changes to maximal grip strength.[1] However, it should be mentioned that during their research Hsiao-Yun Chang et al. applied KinesioTex tape from insertion to origin with a 15–20% stretch tension and it was taped along the medial edge of the forearm to wrap the common wrist flexor muscles. This particular technique, according to Dr. Kenso Kase, is supposed to inhibit muscle function.[6]

2. Aim

The aim of our study was to evaluate whether Kinesio Taping can increase maximal grip force and maximal key pinch force for healthy non-athletic subjects after 30 min and 1 h following the application of KinesioTex Gold tape using the technique, which, according to its founder, is designed to facilitate the muscles as well as add functional correction stimulating finger flexion.

3. Materials and methods

In total, 54 healthy non-athlete volunteers (34 women, 20 men) participated in the research. Prior to the research, all subjects were interviewed and inspected as regards the following exclusion criteria: hand trauma, former surgery, impaired hand function, present pain or other kinds of complaints in the hand area, very hairy or very fragile skin. Only if none of these conditions was found, subjects were involved in the research. The study was approved by the appropriate ethics committee related to the institution (Rehabilitation Department, Medical Academy, Lithuanian University of Health Sciences, Kaunas, Lithuania) in which it was performed. All included volunteers were informed about the sequence of the research procedure and understood its details, and signed an informed consent prior to participation.

Both hands of subjects were used for the research. For 32 hands (Kinesio Taping group) special Kinesio Taping technique, supposed to facilitate main muscles responsible for maximal grip and key pinch and increase grip and key pinch forces, was applied; for 22 hands (placebo group) placebo taping was applied using nonelastic medical tape; and for 54 hands (control group) no taping technique was applied. Subjects who were included in the placebo group knew nothing about the Kinesio Taping method.

According to biomechanical principles, main muscles, which interact in order to make a fist and are responsible for maximal grip force, are not only finger flexors, but also wrist extensors. The latter stabilize the wrist by blocking wrist flexion tendency caused by activated flexors muscles. During a strong grip, wrist extensors hold the wrist at about 35° of extension and nearly 5° of ulnar deviation, thus optimizing the length-tension relationship of the extrinsic finger flexors, thereby facilitating maximal grip strength. Key pinch is another important function of the hand. Key pinch is the ability to pinch an object between the thumb and the lateral side of the index finger. Several muscles interact to produce key pinch force, most notably – the first dorsal interosseus and the adductor pollicis.[7] These biomechanical principles determined our choice for the selection of the muscles to be taped in the facilitating technique in order to try to increase maximal grip and key pinch forces. A dynamometer was used for maximal grip force measurement, and a manometer for maximal key pinch force measurement.

First all subjects, in standardized position, were asked to press a dynamometer and a manometer with maximal strength, and to repeat this thrice with a 1 min rest break between measurements. The mean of these three measurements was deemed as the initial (start-up) maximal grip or key pinch force.

3.1. *Kinesio Taping group*

After the first measurement of maximal grip and key pinch forces for 32 subjects, one hand of each subject was taped using KinesioTex Gold tape, which was placed directly on the skin in the muscle facilitating technique following the school of Dr. Kenso Kase. The taped muscles included the following: flexor digitorum superfitialis, flexor digitorum profundus, extensors of the wrist, adductor policis, flexor policis brevis, and first interosseus dorsalis. KinesioTex Gold tape was placed on the skin from origin of these muscles to insertion using a 15–25% tension of the tape ("paper off" tension) (Figs. 1–3). Additionally, the functional correction technique was applied in order to stimulate finger flexion (the tape was placed on fully actively extended fingers from the metacarpophalangeal joint towards finger tips; 100% tension of the tape was used; and no tension at both ends of tape) (Fig. 4). For the final view of the arm following the Kinesio Taping application, see Figs. 5 and 6.

Maximal grip and key pinch force measurements were repeated in the same standardized manner after 30 min and 1 h following the Kinesio Taping application, with the tape remaining in situ.

3.2. *Placebo Taping group*

For 22 subjects, who knew nothing about the Kinesio Taping method, after the first measurement of maximal grip and key pinch forces, one hand of each subject was taped employing the same technique as in the Kinesio Taping group, but with nonelastic 5 cm wide medical tape (Mefix) (Figs. 7 and 8).

Fig. 1 – Kinesio Taping for muscle facilitation. KinesioTex Gold tape was placed on the skin from origin of the finger flexors and extensors to insertion using a 15–25% tension of the tape ("paper off" tension).

Fig. 2 – Kinesio Taping for muscle facilitation. Muscle facilitating Kinesio Taping technique for m. adductor policis, m. flexor policis brevis and functional correction stimulating flexion of the first finger.

Fig. 3 – Kinesio Taping for muscle facilitation. Muscle facilitating Kinesio Taping technique for first interosseus dorsalis.

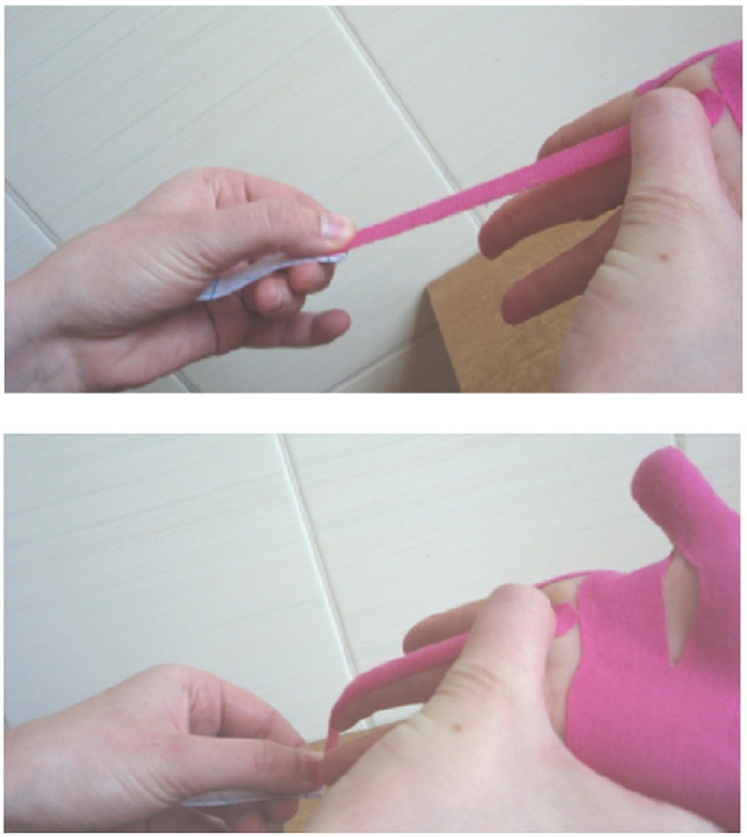

Fig. 4 – Functional correction. Functional correction Kinesio Taping technique for stimulating finger flexion (the tape was placed on fully actively extended fingers from metacarpophalangeal joint towards finger tips; 100% tension of the tape was used; and no tension at both ends of the tape).

Maximal grip and key pinch force measurements were repeated in the same standardized manner after 30 min and 1 h following the placebo application, with the tape remaining in situ.

3.3. *Control group*

For 54 hands, which were not taped, maximal grip and key pinch forces were measured in the same standardized

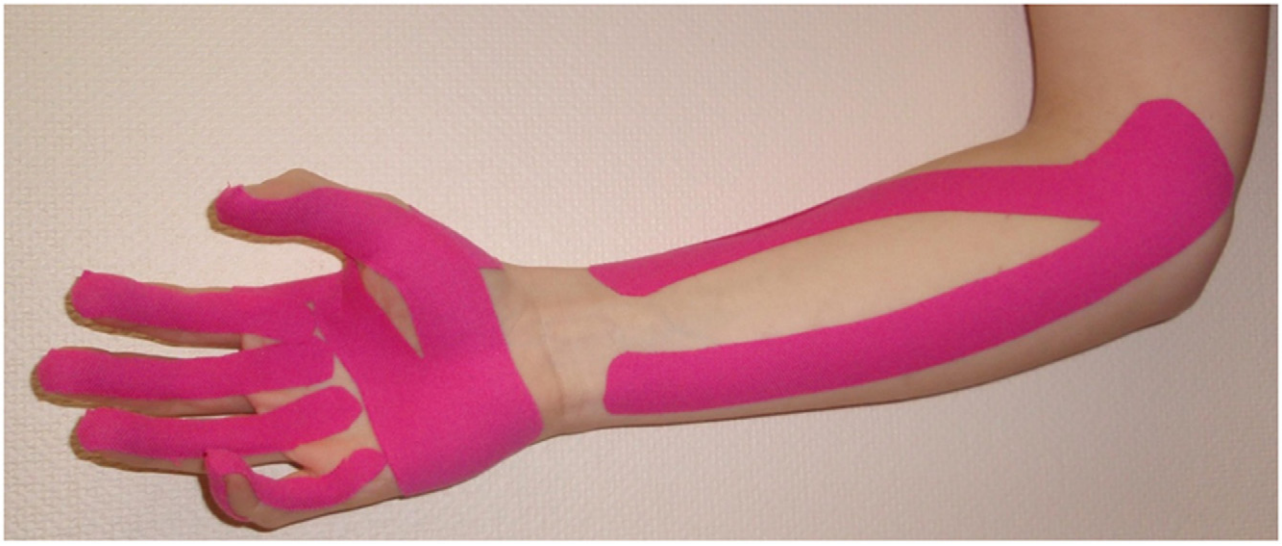

Fig. 5 – Arm after completed Kinesio Taping application (frontal view).

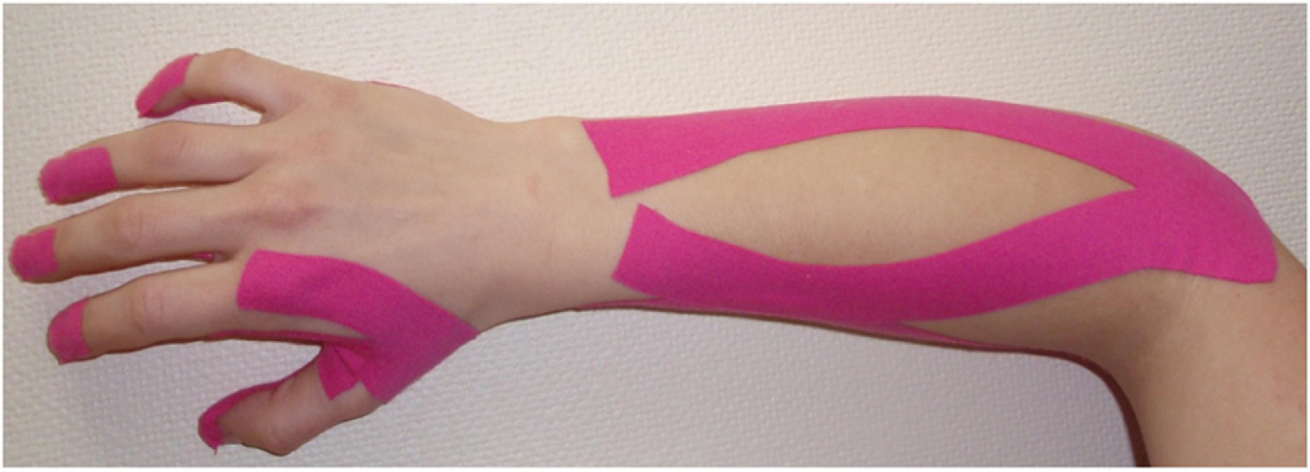

Fig. 6 – Arm after completed Kinesio Taping application (dorsal view).

Fig. 7 – Arm after completed placebo taping application (frontal view).

Fig. 8 – Arm after completed placebo taping application (dorsal view).

manner after 30 min and 1 h following the initial measurement.

All groups were homogeneous with respect to age, sex, dominant and non-dominant hands ($p>0.05$). All subjects reported a light level of physical activity in their daily lives. The average age was 27.9±9.2 years. Kinesio taping and placebo taping were performed by a certified Kinesio Taping practitioner or a final year medical student under close supervision of a certified Kinesio Taping practitioner. The same procedure to press a dynamometer and monometer with maximal force was used for each measurement in every group for all subjects by the same researcher.

Statistical analysis was performed by using the SPSS Statistics 15.0 for Windows package. In the study, absolute data numbers (n) and the mean of registered indexes with the standard deviation (SD) were indicated. For checking the hypotheses of the regularity of distribution of the parameters, the Kolmagorov–Smirnov test was applied. For comparisons of the quantitative variables of two independent groups, the parametric Student's t-test and non-parametric Mann–Whitney test were applied. For comparisons of two dependent quantitative signs, we applied the parametric paired Student's t-test and the non-parametric Wilcoxon test. For checking the hypotheses of the correlation between categorized signs, χ^2 criterion was applied and in the case of a low number of cases ($n<5$) – the exact Fisher criterion. The chosen level of significance for checking the statistical hypotheses was $p<0.05$. In order to reasonably dispose of a false hypothesis, the power of the study was calculated. For the evaluation of the power, the following sizes of the researched groups were taken: n_1, n_2 and mistake of type I $\alpha=0.05$. If the power of the test exceeded 0.8 under these conditions, it meant the mistake of type II $\beta\leq0.2$ and the difference was statistically significant.

4. Results

No statistically significant changes in maximal key pinch force after 30 min were observed in the Kinesio Taping group; however, 1 h following the application maximal key pinch force in the Kinesio Taping group increased (7.5±2.3 kg) in comparison with the initial value (7.2±2.4 kg) ($p=0.033$, $\beta=0.3$). Maximal grip force in the Kinesio Taping group statistically significantly increased both after 30 min (38.7±11.2 kg) ($p=0.006$, $\beta=0.2$) and 1 h following the application (39.3±11.8 kg) ($p=0.001$, $\beta<0.2$) in comparison with the initial value (36.5±10.4 kg). No statistically significant changes in maximal key pinch and grip forces were observed in the placebo and control groups, $p>0.05$. The results of changes in maximal grip and key pinch forces values of each group are presented in Figs. 9 and 10.

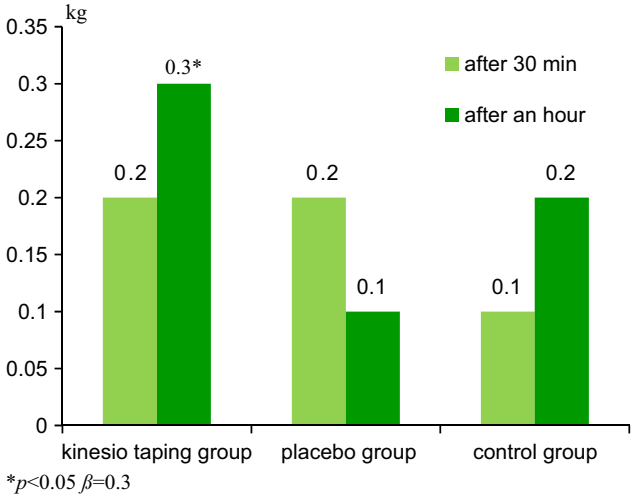

Fig. 9 – Maximal key pinch force changes in groups after 30 min and 1 h.

5. Discussion

We managed to find only one study analyzing the effect of Kinesio Taping on maximal grip strength performed by Chang, Chou and colleagues. They concluded that Kinesio Taping resulted in no changes in maximal grip strength.[1] However, our research results suggest that Kinesio Taping increases maximal grip force after 30 min and 1 h following the application. Such a contradiction, we believe, can be partially explained by the different protocols used: Chang et al. used the inhibitory muscle taping technique for wrist flexors, while we used the muscle facilitating taping

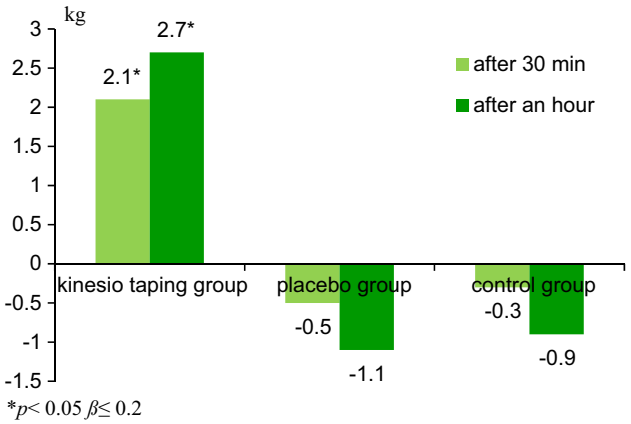

Fig. 10 – Maximal grip force changes in groups after 30 min and 1 h.

technique for wrist flexors as well as extensors; the time period within which repeated strength measurements were made also differs: in their study Chang et al. analyzed immediate effects of Kinesio Taping after the application, while we took repeated measurements after 30 min and 1 h following the application.

The exact time period when Kinesio Taping application begins to produce the desired effect on muscle strength and the duration of such an effect are still unknown. It is thought that the effect of Kinesio Taping on muscles is due to the reflex mechanism on the nervous system.[2,6,8] Some studies found an increased recruitment of motor units and an increased bioelectrical activity immediately following the Kinesio Taping application[2,8] and an increase in muscle strength;[1] however, in their pilot study Fu et al. found no difference in quadriceps and hamstring muscle power either immediately after taping or 12 h after taping with the tape remaining in situ.[3] The results of a study by Vithoulk et al. suggest that the application of Kinesio Taping on the anterior surface of the thigh, in the direction of vastus medialis, lateralis and rectus femoris fascia, could increase the eccentric muscle strength in healthy adults.[9] Other researchers, Słupik et al., found no statistically significant changes in peak torque after 10 min; however, the bioelectrical activity of muscles significantly increased after 24 h of Kinesio Taping use and that effect remained for another 48 h following the removal of the tape. Słupik et al. and Karwacińska et al. concluded that Kinesio Taping employed shortly before the motor activity it is supposed to support may fail to fulfill its function.[5,8] This would support our results with Kinesio Taping concerning the effects on maximal key pinch force as showing no statistically significant changes in key pinch force 30 min following the application; only after 1 h maximal key pinch force increased ($p<0.05$). However, our study power according to this criterion was 0.7 ($\beta=0.3$), which means that Kinesio Taping, applied according to our proposed technique, showed the tendency to increase maximal key pinch force for healthy subjects 1 h following the application. More subjects should be investigated to state that it statistically significantly increases key pinch force. However, our study power for maximal grip force criteria is not less than 0.8; thus, our sample size is sufficient to conclude that the applied Kinesio Taping technique statistically significantly increased maximal grip force after 30 min and 1 h following such application. Though our research does not provide an answer as to when the effect of Kinesio Taping technique begins and how long it lasts (this still remains the issue for further studies), we think our findings provide some encouragement for utilizing such Kinesio Taping technique in sports or in clinical practice for subjects for whom increased grip and key pinch forces are needed. Nevertheless, it is worth remembering that our study involved healthy subjects. What it is still unknown is whether Kinesio Taping will produce the same effects on muscle strength in subjects whose muscle strength may be compromised due to neurological diseases. Further studies are needed in this area.

6. Conclusions

Kinesio Taping applied in the technique supposed to facilitate muscles and stimulate finger flexion did not result in significant changes in maximal key pinch force after 30 min ($p>0.05$), but increased maximal key pinch after 1 h ($p<0.05$, $\beta=0.3$) and maximal grip force after both 30 min and 1 h following such application ($p<0.05$, $\beta\leq0.2$).

Conflict of interest

None declared.

Acknowledgments

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