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Original Article

Effects of kinesio tape compared with non-elastic tape on hand grip strength

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Abstract. [Purpose] Many assumptions have been made about taping and several studies have considered tape application methods; however, the true effect of taping on muscle strength remains unclear. Most previous studies compared application techniques using Kinesio tape (KT), but studies that compared muscle strength using non-elastic tape (NT) are limited. Moreover, no studies have applied KT and NT in the same way to assess grip strength in normal subjects. The purpose of this study was to evaluate the immediate effect of application of two tapes with different elastic properties on maximal grip strength in healthy adults. [Subjects and Methods] Twenty healthy adults were divided into two groups (KT and NT). Maximal grip strength was measured with a dynamometer. Forearm extensor muscles of the dominant hand were then taped and subjects were immediately asked to perform hand grip movement with maximum strength in the same standardized manner. [Results] In the KT group, maximal grip strength was significantly increased compared to the initial value; however, in the NT group, there was no significant difference in maximal grip strength. [Conclusion] This study suggests that only Kinesio tape can increase maximal grip strength immediately after application on the extensor region of the forearm.
Key words: Kinesio tape, Non-elastic tape, Muscle strength

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INTRODUCTION

Grip strength indicates the ability of hand muscles to grip, and has been used for risk stratification to predict future health problems in individuals[1)], to assess upper limb impairment, or to develop a suitable treatment plan[2)]. A decrease in grip strength makes it difficult for subjects to use their hands for many daily activities, and recovery from this muscle weakness is a major goal of rehabilitation[3)].

According to biomechanical principles, gripping force is produced by the complex activation of forearm muscles, with co-contraction of forearm flexors and extensors[4)]. In particular, it has been reported that the strength of wrist extensors is highly correlated with grip strength[3–5)]. During grasping, the wrist should be stabilized by wrist extensors at a fixed position of approximately 30° of wrist extension[3)] and nearly 5° of ulnar deviation[5)]. In a study by Shimose et al.[4)], wrist extension training was performed and led to an increase in gripping force and increased activation of wrist extensors after training.

Adhesive taping has been used as a therapeutic modality, and is clinically effective in reducing pain, improving joint movement, increasing muscle strength, performing fascial and mechanical correction, enhancing blood and lymphatic circulation, and stimulating sensory mechanisms[2, 5–9)]. Kinesio tape (KT) with elastic properties was developed by Kenzo Kase in 1973[5, 9, 10)], and the taping method originated from the hypothesis that an external component could aid the functions of muscles and other tissues[10)]. The stretch applied on the tape provides a pulling force on the skin and creates more space by lifting the fascia and soft tissue[9)], which improves communication with mechanoreceptors and increases the number of motor

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units recruited[10]. Non-elastic tape (NT) was first introduced in 1984 by Jenny McConnell[11], and includes the application of a protective undertape, followed by a rigid overtape which is used to apply tension[12]. It has been reported to enhance muscle activity, improve joint alignment, affect proprioception and neuromuscular control, and restore functional movement[12–15].

Subsequently, Kase reported that one of the effects of Kinesio tape is to increase muscle strength[9], and several studies have been conducted with respect to tape application methods. However, the true effect of taping on muscle strength remains unclear[2, 8]. Moreover, most previous studies compared application techniques using elastic taping, but studies that evaluated muscle strength using NT are limited. Moreover, none of the studies have applied NT and KT in the same way to assess grip strength in normal subjects. The purpose of this study was to evaluate the immediate effect of forearm Kinesio taping and Non-elastic taping application on maximal grip strength in healthy adults. We hypothesized that application of both tapes can improve muscle strength by facilitating contraction.

SUBJECTS AND METHODS

A total of 20 healthy adults participated in this study, and were divided into two groups (KT and NT). The age range of subjects was 24 to 34 years. Inclusion criteria were absence of any known cardiopulmonary conditions and previous surgery on the tested upper extremity, and absence of any active joint pain or other related symptoms in the prior 6 months[8]. Exclusion criteria were very hairy or very fragile skin[5], central or peripheral neurological deficits, or consumption of alcoholic beverages or pharmaceutical substances 24 hours prior to the start of this study[10].

All subjects were informed about and understood the details of the research procedure, and provided signed, informed consent prior to participation, in accordance with the ethical standards of the Declaration of Helsinki. The present study was conducted in a single-blind fashion so that the subjects did not realize the purpose of the experiment.

The experiments were performed in a standardized manner. Participants were seated in a chair without leaning, with the shoulder in slight abduction (15°), the elbows in 90° flexion, and forearms neutral in supination/pronation[1, 3]. In all subjects, maximal grip strength was first measured with a JAMAR Digital hand dynamometer (Sammons Preston, USA), and the reliability test for the hand dynamometer indicated an intraclass correlation coefficient of 0.973[9]. The subjects were asked to grip the handle of the dynamometer with maximum effort for 3 s with a one-minute rest break between trials, and the values of the 3 trials were recorded[2, 3, 9]; this was considered the initial maximal grip strength[5]. After the measurement of maximal grip strength, one hand of each subject was taped and subjects were immediately asked to perform the hand grip movement with maximum strength in the same standardized manner.

The tape was applied on the dominant hand based on the Edinburgh Handedness Inventory, and the principal investigator applied the tape for all subjects[2, 8]. For most of the basic applications, the muscle and tissue were placed in a stretched position, and all subjects were asked to perform elbow joint extension with wrist joint flexion while the tape was being applied. Based on a study by Kouhzad Mohammadi et al.[2], the length of the tape was measured from 2 cm inferior to the lateral epicondyle of the humerus to the styloid process of the radial wrist joint line before application. The area to be taped was cleaned with an alcohol swab[16], and the I-shaped Kinesio Tex Tape was applied over the common wrist extensor muscles from their origin to insertion with 50% stretch tension in order to facilitate muscle function[2, 5, 9]. Using the KT methods, the NT was applied in the same position and direction. A protective hypoallergenic tape (Endura Fix Tape, Endura-Tape Pty. Ltd., Australia) was carefully applied over the skin without creating tension, and a rigid non-elastic tape (Endura Sports Tape, Endura-Tape Pty. Ltd., Australia) was applied directly over the undertape with enough tension to create crimping or puckering of the skin[12].

SPSS software was used to examine the change in maximal grip strength after forearm taping. $p<0.05$ indicated statistical significance. The Shapiro-Wilk test was used to check the normal distribution of data before analysis[2]. Because the collected data did not meet the normality assumption ($p<0.05$), two non-parametric tests were used. For comparisons between the two independent groups (KT and NT), the Mann-Whitney U test was applied. For comparisons between two dependent quantitative signs, we applied the Wilcoxon signed-rank test. As non-parametric tests were used, median values replaced mean values for comparison[11].

RESULTS

No significant difference was found in the maximum grip strength between the two groups ($Z=-1.066$, Asymp. Sig. (2-tailed) = 0.287). However, in the KT group, the maximal grip strength was significantly increased compared to the initial value ($Z=-2.519$, Asymp. Sig. (2-tailed) = 0.012); in the NT group, there was no significant difference in the maximal grip strength ($Z=-0.354$, Asymp. Sig. (2-tailed) = 0.723). Table 1 shows the maximal grip strength just before and immediately after application of the tape.

Table 1. Changes in maximal grip strength (kg) just before (pre) and immediately after (post) taping

	Pre-test	Post-test
	M ± SD	M ± SD
KT group*	31.6 ± 7.1	33.1 ± 8.4
NT group	36.1 ± 11.6	35.9 ± 11.7

Median values were used for comparison.
*p<0.05. Values are means ± SD.

DISCUSSION

A recent study showed that there is a strong correlation between grip strength and wrist extension strength[3], with the tape applied over the forearm extensor muscles to determine the change in the maximal grip strength. The use of adhesive tape is gradually increasing in the clinical field, and several studies have examined it as a therapeutic intervention that may lower costs and improve outcomes[6]. It has been suggested that both rigid and elastic taping techniques alter muscle force, neuromuscular control, and proprioception[17].

This study examined the effects of two tapes with different elastic properties on maximal grip strength. First, significant increases in maximal grip strength were observed immediately after Kinesio taping over the extensor region of the forearm. Previous studies reported the same results[2, 5, 10]; in particular, the study by Lemos et al.[10] showed that the increase in grip strength was maintained for 48 h after the application of KT.

However, the working mechanism of KT remains unclear. It is thought that the effect of Kinesio taping on muscles is due to the reflex mechanism of the nervous system. Most studies have reported that taping over the skin constantly stimulates cutaneous mechanoreceptors, thus providing more sensory signals to the central nervous system for information integration[2, 5, 9, 11, 18]. In addition, reduction of motor neuron threshold induced by cutaneous stimulation would influence the recruitment of the motor unit, which can facilitate muscle contraction, and ultimately improve muscle strength[5]. Kouhzad Mohammadi et al.[2] also suggested that Kinesio taping increases sensory feedback of the taped region through skin stretching, thus facilitating contraction of inactive muscles[10].

Although the working mechanism of NT has been shown to be similar to that of KT[13, 16], no effective change in maximal grip strength was noted immediately following the application of NT. As in our study, Donec et al.[5] applied 5-cm wide NT medical tape (Mefix) in a placebo group and compared it with a KT taping group, and found a significant difference in maximal grip strength in only the KT group. Alexander et al.[12, 15] applied NT on the skin overlying the lower fibers of the trapezius and gastrocnemius in healthy subjects, and motor-neuron pool excitability was assessed using the Hoffmann reflex (H reflex). The result was surprising in view of the fact that taping is thought to facilitate muscle fibers; however, taping was found to inhibit the H reflex.

We assume that these results considered the muscle length using rigid NT application methods. Unlike KT, NT was applied with enough tension to create crimping or puckering of the skin. Alexander et al.[12, 15] suggested that if the muscle is held in a shortened position by the tension of the tape, there may be reduction in tonic muscle spindle activity. Reduction in the spindle afferent input may lead to its inhibition[15].

The reason grip strength was not increased in another study should be discussed[8, 9, 19, 20]. Different taping application techniques with different tensions and forms can provide different tactile stimuli[19]. Cai et al.[8] did not find a significant difference in maximum grip strength. While we applied the tape in the direction of muscle origin to insertion with 50% of its maximal length tensed in the stretched position, they applied 75% tension. In another study by Chang et al.[9], KT was applied over the common wrist flexor muscles from their insertion to origin with 15–20% tension in healthy subjects, and there was no statistically significant difference. In contrast, the study by Kouhzad Mohammadi et al.[2] showed that there was a significant association between grip strength and taping region, and that taping of the extensor region increased the maximal grip strength significantly, compared to taping of the flexor region.

In our study, NT did not increase muscle strength, but Park and Kim[21] and Lee et al.[13] showed increased grip strength using electromyography in patients with lateral epicondylalgia, with the tape applied in a spiral or cuff form around the elbow joint. Moreover, the study by Chou et al.[22], in which the tape was applied from the distal end of the lateral malleolus, wrapping around the posterior lower leg in subjects with chronic ankle instability, found a significant increase in H:M ratio in the soleus muscle.

Although taping techniques are used in clinical practice in order to achieve various therapeutic effects, there is limited evidence regarding the effects on muscle strength. Two types of tapes were applied in the same way, and the results showed that the KT group had a statistically significant difference in muscle strength; however, in the NT group, there was no difference in muscle strength. We believe our research will provide guidelines for clinical practice for use in subjects who need to increase their muscle strength with use of the tape.

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