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Influence of Kinesio Taping on the Motor Neuron Conduction Velocity

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Abstract. [Purpose] The objective of this study was to investigate whether Kinesio taping (KT) exerts influence on the motor nerve conduction velocity. [Subjects and Methods] Seventeen healthy participants (male 9, female 8) with no pathology or past history of a peripheral and central neuropathy who were working at the Jinju Seran hospital voluntarily participated in this study. Their mean age was 34.3 years (range=25–52 years), their mean height was 167.1 cm (range=158–177 cm), and their mean weight was 56.9 kg (range=45–73 kg). All participants received bipolar percutaneous stimulation by orthodromic conduction delivered by a EP/EMG system (MEB-9200, Nihon Kohden, Japan) with a pulse duration of under 1 ms. Ulnar and median nerves were stimulated with 20 mA and the radial nerve was stimulated with 30mA. The motor nerve conduction velocity was measured with and without the application of KT. [Results] Statistically, there were no significant differences between with and without KT in the latency, amplitude, and motor nerve conduction velocity of the median, ulnar, and radial nerves. [Conclusion] The results of this study suggest that Kinesio taping neither increases nor decreases motor nerve conduction velocity.
Key words: Kinesio, Taping, Velocity

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INTRODUCTION

Taping can largely be classified into two types, elastic and non-elastic taping. Kinesio taping (KT) is an elastic type, and is mainly used by physical therapists and sports professionals. KT is an adhesive tape developed by Kenzo Kase in 1996. It is thin and has high elasticity that enables the tape to extend to 120–140% of its original length, with less mechanical constraint than non-elastic tape. Therefore, when it is applied to the muscle or to the joint, it allows only a certain portion to move with adjustment in forces to stretch the skin[1)].

Regardless of taping types, taping has been reported to reduce sports injury, osteoarthritis, myofascial pain syndrome, and patellofemoral pain syndrome, as well as pain, swelling and muscle spasms of patients with nervous system disorders, while increasing the range of motion and muscle power; It is also effective in correcting walking pattern and functionality[1–9)].

Taping is also a treatment that controls agonists and antagonists, promotes agonists, enhances optimal inter-articular coordination, normalizes static and dynamic posture and related movements as well as reducing pain caused by movement, both directly and indirectly[10)].

What kind of impact does taping have on the excitability of muscles of normal healthy person? Investigation of this issue began after Alexander et al.[11)] reported the results of measurement of H-wave amplitude with placement of taping on the skin.

Currently, taping's effectiveness lack a scientific proof. Most of the theories presented have emphasized proprioception or mechanical effect but at present there is no definitive conclusion regarding these effects[12)].

Tactile stimulation of the skin through taping influences the excitability of the central nervous system and also interacts with motor control[13)]. Tactile input through the skin is known to be more than sufficient to change muscle power[2)]. However, some studies have reported contradictory results.

For example, Morrissey[10)] reports that when taping is applied to an under-active muscle, it reduces the length of the muscle and thus moves the length-tension curve toward the left while resting. Alexander et al.[11,12] argued that the excitability of motor neurons decreases with taping in the direction of the muscle fiber, while Tobin and Robinson[14] reported that taping the muscle in a crossing pattern results in a noticeable reduction in muscle activity. In contrast, Chen et al.[2] Cools et al.[15] and Fu et al.[16] reported that taping of the skin had no effect on the excitability of the muscles of healthy persons.

In the present study, we measured the nerve conduction velocity (NCV) to find out what kind of effect KT has on the excitability of motor neuron.

SUBJECTS AND METHODS

A total of 17 people participated in this research, 9 males and 8 females. The mean age of the participants was 34.35 years, ranging from 25 to 52 years. The average height of the participants was 167.06 cm, ranging from 158 to 177 cm. The average weight of the participants was 56.94 kg, ranging from 45 to 73 kg. All the participants were the employees of the Jinju Seran Hospital, who volunteered to participate in this study. All were normal healthy people without any neurological problems. The study conformed to all standards for the use of human participants in research as outlined in the Declaration of Helsinki, and signed consent was received from all the participants prior to their participation in this study.

Motor nerve conduction velocity is usually tested in the radial, ulnar and median nerves, so we also selected those nerves of the dominant hand for testing. All test participants were placed in the supine position. Orthodromic conduction was applied using a bipolar percutaneous stimulator, EP/EMG system (MEB-9200, Nihon Kohden, Japan), with a pulse duration of 1 ms. The current intensities applied to the ulnar nerve and median nerve were 20 mA, while that for radial nerve was 30 mA. Measurement of the median nerve was conducted at the abductor pollicis brevis, while the ulnar nerve was measured at the abductor digiti minimi and the radial nerve was recorded at the extensor indicis proprius. All participants had their latency, amplitude and motor nerve conduction velocity measured before the application of KT. After a short rest, participants were taped with KT and re-measured at each nerve.

KT was placed on the volar side of the forearm. First, KT was cut according to the length of each participant's forearm, then applied while the participant's radiocarpal articulation was in maximum extension, beginning from the distal end and ending at the proximal end.

Latency, amplitude and nerve conduction velocity of the radial nerve, ulnar nerve and median nerve prior to and after the application of KT were compared using the paired t-test SPSS Win 14.0. Values of p less than 0.05 were regarded as statistically significant.

RESUTLS

As seen in Table 1, the latency and amplitude of the median nerve after taping was slightly reduced when compared to prior to taping, while nerve conduction velocity was slightly increased but without statistical significance ($p>0.05$). Values of latency, amplitude and nerve conduction velocity of the ulnar nerve after the taping showed slight increases when compared to prior to taping, but without any significant differences ($p>0.05$). Values of the latency and amplitude of the radial nerve after taping showed a slight decrease, while nerve conduction velocity showed a slight increase after taping, however, the difference were not significant ($p>0.05$).

Table 1. Average and standard deviation of latency, amplitude and NCV of the median, ulnar and radial nerves before and after the application of KT

		Before Mean ± SD	After Mean ± SD
Median nerve	Latency (ms)	6.83 ± 0.71	6.80 ± 0.63
	Amplitude (mV)	16.76 ± 3.37	16.07 ± 3.80
	NCV (m/s)	60.36 ± 4.42	61.09 ± 5.04
Ulnar nerve	Latency (ms)	6.10 ± 0.51	6.15 ± 0.66
	Amplitude (mV)	14.51 ± 3.19	14.77 ± 2.41
	NCV (m/s)	60.58 ± 5.05	61.92 ± 4.87
Radial nerve	Latency (ms)	4.42 ± 1.12	4.22 ± 0.57
	Amplitude (mV)	5.59 ± 1.09	5.54 ± 1.17
	NCV m/s)	59.48 ± 6.72	59.65 ± 6.73

NCV: nerve conduction velocity.

DISCUSSION

Nerve conduction velocity is a reflection of the monosynaptic reflex and reduction in latency, increases in amplitude and nerve conduction velocity of motor neurons signify increases in their excitability (or firing). On the other hand, increase in latency and reductions in amplitude and nerve conduction velocity signify the reduction of excitability of motor neurons[12].

In the present study, we applied KT to the antebrachial ventralis (radiocarpal articulation) of the forearm of normal healthy participants and observed the effects on conduction velocity of motor neurons. The result showed no statistically significant differences between latency, amplitude and nerve conduction velocity of the radial, ulnar, and median nerves between before and after taping. Accordingly, what we discovered through the result of this study is that tactile stimulation of the skin by KT does not affect the conduction velocity of motor neurons at all.

The therapeutic effect of Kinesio taping is derived from cutaneous receptors, and is related to the clinicopathologic condition. In other words, when tape is used to apply tactile stimulation to painful tissues, rather than afferent nerve fibers delivering a sense of pain (Aδ and C), tactile neurons with faster conduction velocity induced by the tactile stimulation of the taping (Aβ) connect to substantia gelotinosa (SG) of the posterior horn creating presynaptic inhibition which reduces the pain. This explanation is based on gate control theory.

However, what kinds of effects are seen in normal healthy participants with KT? What kind of changes take place? Morrissey[10], postulated that taping the skin results in shortening of the muscle's length, prompting it's length-tension curve to move toward the left and resulting in an ideal cross-bridge of actin and myosin as well as an increase in muscle power.

On the other hand, Alexander et al.[11,12] proposed that if the length of tape is shortened according to the length of the muscle, then the actual length of the muscle will also be shortened as well as intrafusal fiber of the muscle spindle leading to reduction of the load that is applied to the muscle spindle. Therefore, if the length of the intrafusal fiber is actually shortened by the taping, then the tonic discharge rate of the muscle spindle will also be reduced, leading to a reduction in the excitability of the motor neurons. The result is a reduction in the amplitude of the H-reflex and an eventual reduction in muscle activity[12].

If this is the case, then why is taping not effective in normal healthy adults, as seen not only in this study but also in previous studies by Chen et al.[2]. Cools et al.[15]. and Fu et al.[16]? Perhaps the simple answer in the one given by Cowan et al.[17] who stated that since normal healthy adults do not have any pains, reduction of muscle power does not take place, and therefore no change in muscle power is shown.

The hypothesis of Alexander et al.[11,12] provides the basis for this explanation. In other words, alpha-motor neurons which innervate skeletal muscle and gamma-motor neurons which innervate muscle spindles are not individually activated but are activated simultaneously. This phenomenon is called alpha-gamma coactivation[18].

Unlike skeletal muscle fiber, when muscle spindle fiber contracts, the sensitization of groups Ia and II afferent nerve fibers does not reduce but rather is maintained in a state of continuous excitement[18] The result is that excitability of motor neurons neither decreases nor increases but rather continues at the same level. Accordingly, if the skeletal muscle underneath the skin is actually shortened by the tape, then, as seen from the result of this study, there will not be any changes in latency, amplitude or nerve conduction velocity of the motor neurons through continuous input of afferent neuron from the muscle spindle fiber.

Tactile stimulation applied to the skin requires certain uniform period for the normalization of proper feedback and complete motor engram to take place,[10] thus the application period of this study may have been too short. O'Donovan[19] explained the inhibition effect of taping on the trapezius (upper back) as taking place immediately upon placement of the tape through tactile stimulation of the skin. In addition, tactile input to the skin creates changes in excitability of the central nervous system, which is known to result in interaction with motor control[13].

This study applied tactile stimulation to the volar side of antebrachial region by application of KT. However, no effect of the taping was observed. What we can learn from this study and previous studies with similar results is that we can't discount the fact that tactile stimulation created by KT may not be enough to correct the muscle power of normal healthy adults[16] However, future studies using stronger tactile inputs from taping may possibly show changes in muscle activities.

Two inferences can be drawn from the results of this study. First, stimulation of the skin by KT may not be enough to create changes in muscle activity. Second, the studies by Morrissey,[10] and Tobin and Robinson[14] used non-elastic sports tape and McConnell tape, therefore there were possible differences in the degree of tactile stimulation of the skin compared to the elastic KT used in this study.

REFERENCES

1) Halseth T, McChesney JW, DeBeliso M, et al.: The effects of Kinesio taping on proprioception at the ankle. J Sports Sci Med, 2004, 3: 1–7.
2) Chen WC, Hong WH, Huang TF, et al.: Effects of kinesio taping on the timing and ratio of vastus medialis obliquus and vastus lateralis muscle for person with patellofemoral pain. J Biomech, 2007, 40 (S2).
3) Conway A, Malone T, Conway P: Patellar alignment/tracking alteration: effect on force output and perceived pain. Isokinetics and Exercise Science, 1992, 2: 9–18.
4) Ernst GP, Kawaguchi J, Saliba E.: Effect of patellar taping on knee kinetics of patients with patellofemoral pain syndrome. J Orthop Sports Phys Ther, 1999, 29: 661–667.
5) Garcia-Muro F, Rodriguez-Fernandez AL, Herrero-de-Kucas A: Treatment of myofascial pain in the shoulder with Kinesio Taping, A case report. Manual Therapy, 2010, 15: 292–295.
6) Herrington L: The effect of patellar taping on quadriceps peak torque and perceived pain: a preliminary study. Phys Ther In Sport, 2001, 2: 23–28.
7) Hinman RS, Bennell KL, Crossley KM, et al.: Immediate effects of adhesive tape on pain and disability in individuals with knee osteoarthritis. Rheumatology, 2003, 42: 865–869.
8) Kalichman L, Vered E, Volchek L: Relieving symptoms of meralgia paresthetica using Kinesio Taping: A pilot study. Arch Phys Med Rehabil, 2010, 91: 1137–1139.
9) Kowall M, Kolks G, Nuber G, et al.: Patellar taping in the treatment of patellofemoral pain. Am J Sports Med, 1996, 24: 61–66.
10) Morrisey D: Proprioceptive shoulder taping. J Bodywork Movement Ther, 2000, 4: 189–194.
11) Alexandern CM, Stynesn S, Thomasn A, et al.: Does tape facilitate or inhibit the lower fibres of trapezius?. Manual Therapy, 2003, 8: 37–41.
12) Alexander CM, McMullan M, Harrison, PJ: What is the effect of taping along or across a muscle on motorneuron excitability? A study using Triceps Surae. Man Ther, 2008, 13: 57–62.
13) Simoneau JA: Changes in ankle joint proprioception resulting from strips of athletic tape applied over the skin. Journal of Athletic Training, 1997, 32: 141–147.
14) Tobin S, Robinson G: The effect of McConnell's vastus lateralis inhibition taping technique on vastus lateralis and vastus medialis obliquus activity. Physiotherapy, 2000, 86: 173–183.
15) Cools AM, Witvrouw EE, Danneels LA, et al.: Does taping influence electromyographic muscle activity in the scapular rotators in healthy shoulder. Manual Therapy, 2002, 7: 154–162.
16) Fu TC, Wong AM, Pei YC, et al.: Effect of Kinesio taping on muscle strength in athletes —A pilot study. J Sci Med Sport, 2008, 1: 198–201.
17) Cowan SM, Bennell KL, Hodges PW: Therapeutic patellar taping changes the timing of vasti muscle activation in people with patellofemoral pain syndrome. Clinic J Sport Med, 2002, 12, 339–347.
18) Lundy-Ekman L: Neurosicence: Fundamentals for rehabilitation (3rd ed). Saunders, 2007, 198.
19) O'Donovan N: Evaluation of the effect of inhibitory taping on EMG activity in upper and lower trapezius during concentric isokinetic elevation of the upper limb. Unpublished MSc Physiotherapy thesis, UCL, London, 1997.