Acute Effects of Kinesio Taping on Knee Extensor Peak Torque and Electromyographic Activity After Exhaustive Isometric Knee Extension in Healthy Young Adults

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Objective: To evaluate the effect of Kinesio Tex tape and its method of application, Kinesio Taping (KT) on knee extensor performance before and after an exhaustive isometric knee extension exercise.

Design: Single-blinded, randomized control trial.

Setting: Centre for Sports Training and Rehabilitation at The Hong Kong Polytechnic University.

Participants: Twenty-six healthy volunteers with no history of knee injuries.

Interventions: Subjects were randomized to either the KT or sham taping group.

Main Outcome Measures: The effects of KT on the neuromuscular performance of the knee extensors were measured before and after KT application, and immediately and 5 and 10 minutes after an exhaustive isometric knee extension exercise.

Results: Within-group analyses revealed a significant effect of time on the peak torque in isometric knee extension \( (F_{2.73,65.44} = 24.5, \ P < 0.001) \), but no significant group \( (F_{2.73,65.44} = 2.13, \ P = 0.11) \) or interaction \( (F_{1.24} = 0.59, \ P = 0.45) \) effect. A significant time effect \( (F_{2.52,60.14} = 3.75, \ P = 0.02) \) and a significant time \( \times \) group interaction \( (F_{1.24} = 4.59, \ P = 0.04) \) was found for the rate of peak torque development. Post hoc comparisons revealed significantly higher rates in the intervention group \( (F_{1.24} = 4.594, \ P = 0.04) \) over all 5 tests. No significant effects of time \( (F_{2.96} = 0.88, \ P = 0.48; F_{2.56,61.35} = 2.75, \ P = 0.06) \), group \( (F_{4,96} = 0.56, \ P = 0.69; F_{2.56,61.35} = 1.16, \ P = 0.33) \), or time \( \times \) group interaction \( (F_{1.24} = 2.77, \ P = 0.11; F_{1.24} = 0.20, \ P = 0.66) \) were found for either the electromechanical delay or electromyographic results, respectively.

Conclusions: The present study suggests that KT shortens the time required to generate peak torque during isometric knee extension, which has important implications for sports performances that require the rapid generation of peak muscular force.

Clinical Relevance: Kinesio taping is commonly seen in the sports arena. The popularity is presumably due to the general belief in its injury prevention and enhancement of muscle performance. The results of the present findings suggested that KT shortens the time to reach peak torque generation. Aside from this, there is no other significant positive effect on muscle performance. Further investigation on the effects of KT on muscle performance is warranted.

Key Words: kinesio tape, vastus medialis oblique muscle, quadriceps, muscle fatigue

(Clin J Sport Med 2014;0:1–7)

INTRODUCTION

Kinesio Tex tape (KTT) and its method of application has recently gained popularity among sports professionals for its assumed injury prevention and performance enhancement. Kinesio Tex tape is a thin, elastic tape that can be stretched up to 55% to 60% of its resting length. It has been suggested by the developer that the design of the KTT aimed to mimic the physical qualities of human skin such that the thickness of KTT approximates the thickness of the epidermis and the degree of stretch approximates the elastic qualities of the skin. The KTT together with its unique application technique, Kinesio taping (KT) method, has been claimed to have beneficial effects on the skin, fascia, circulation, lymphatic system, muscles, and bony system, which might result in pain relief, resolving edema, improve muscle performance, and increase joint stability. However, many of these claimed physiological and therapeutic effects have not been thoroughly investigated or proven.

Despite the popularity of KT for clinical use, the mechanisms underlying the effectiveness of KT have not been tested. One general belief is the application of KT on the skin creates a tactile sensation that activates cutaneous mechanoreceptors, which might help to alleviate the pain sensation through the gate-control theory pioneered by Melzack and Wall, and various expanded pain modulation theories. In addition, the elastic recoil properties of the tape lift the skin to increase the interstitial space, which may enhance lymphatic return. The elastic recoil effect of KT

Submitted for publication September 18, 2013; accepted May 25, 2014.
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Clin J Sport Med • Volume 0, Number 0, Month 2014 www.cjsportmed.com | 1

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has also been proposed to alter length–tension relationships of muscles. Different application methods can enable either facilitation or inhibition of muscle activation. By applying KT from the insertion to the origin of the muscle, its recoil effect induces motor neuron inhibition by stretching the Golgi tendon organs located at the distal end of the muscle. However, applying KT from origin to the insertion end of the muscle facilitates muscle spindle reflex contraction and induces muscle facilitation. This possible mechanism is based on the earlier neurological studies that cutaneous afferents are known to modify the excitability of slow and fast motor units differentially.6,7 and to modulate the activity of the proprioceptive reflex loops.5,9

In the contention of evidence-based practice, a meta-analysis evaluated the effectiveness of KT in the treatment and management of sports injuries. Among the 10 studies included in this analysis, 4 studies reported positive outcomes on muscle strength performance. The authors therefore concluded that KT has a small but beneficial effect on strength performance. However, 3 recent studies that were not included in the meta-analysis report that KT has no acute effect on muscle performance in either healthy individuals or individuals with elbow injury. Two studies have evaluated the effects of KT on electromyographic (EMG) activity. Slupik et al. demonstrated that KT increases the bioelectrical activity of the quadriceps muscle 24 hours after the application and that this effect could be maintained for another 48 hours even after the tape was removed. Hsu et al. reported that KT taping increased the activity of the lower trapezius muscle in the 60-degree to 30-degree arm-lowering phase compared with a placebo taping condition in baseball players with shoulder impingement. However, both studies posed methodological issues, and the authors concluded that no substantial evidence existed to support the use of KT to enhance muscle activity. Furthermore, 2 studies have reported conflicting findings with respect to the effects of KT on proprioception. Halseth et al. reported that KT produced no significant change in the absolute error in ankle joint position sense. However, Chang et al. reported that KT decreased the force sense error in grip strength measurements among 21 healthy college athletes. Thus, the current literature does not provide unequivocal support for the use of KT for muscle performance enhancement.

Muscle fatigue is common in sports activities and has been shown to adversely alter joint proprioception, impair neuromuscular control, and increase the risk of injury. An assessment of KT on muscle performance needs to consider the effects on both fresh and fatigued muscle. Therefore, the aim of this study was to investigate the effect of KT on the neuromuscular performance of the knee extensor before and after an isometric fatigue protocol.

METHODS

Subjects

Twenty-six healthy volunteers (13 males, 13 females; 22.9 ± 3.4 years old) participated in this study. Subjects aged between 18 and 30 years were included in the study. Subjects were excluded from the study if they reported (1) a previous history of knee pathology, (2) skin conditions, (3) an allergy to tape, or (4) any medical condition that would interfere with the test procedure.

The study was conducted in accordance with the Declaration of Helsinki and was approved by the Human Ethics Committee at the Hong Kong Polytechnic University. All subjects signed a written informed consent to participate. Subjects were asked to refrain from vigorous physical activity and alcohol consumption for 1 day before the test procedure.

Study Design

Blocked randomization was performed by a person not directly involved in the study to assign subjects to either the KT group (intervention) or the sham taping group (control). Allocation concealment was maintained using opaque sealed envelopes. Investigators involved in the data collection were blinded to the group assignment.

The intervention group (n = 13) received a standardized KT application for vastus medialis oblique (VMO) muscle activation. A 5-cm Y-shaped Kinesio tape (Kinesio Tex tape; Kinesio holding Corporation, Albuquerque, New Mexico) was anchored at the origin of the VMO muscle at full knee extension, without tension. The subject’s knee was then flexed to 60 degrees (as measured by a goniometer), and 2 Y-shaped tape strips were applied along the border of the VMO muscle at approximately 50% of the available tension length. The taping application ended at the medial part of the quadriceps femoris tendon and the medial border of the patella, without (Figure 1). To ensure the consistent amount of tension applied to each subject, the length of the tape was measured with a ruler before application, and the tape was first stretched to its 100% available tension and was marked by the ruler. It was then stretched to 50% of its available tension. The control group (n = 13) received a sham KT application in the same region with a nonstretchable Fixomull tape (Nitto Denko Corporation, Japan).

Outcome Measures

The effects of KT on the neuromuscular performance of the knee extensors were evaluated with (1) isometric maximal

![FIGURE 1. Application of Kinesio Tex tape to the VMO muscle. The black box denotes electrode placement.](image-url)
voluntary contraction (IMVC) torque, (2) the rate of peak torque development (RPTD), (3) the root mean square of the EMG (rms-EMG) signals, and (4) the electromechanical delay (EMD). All measures were obtained at baseline, after the taping application, immediately after the isometric fatigue protocol, and 5 and 10 minutes after the isometric fatigue protocol. All data were collected on the subject's dominant leg. Figure 2 presents a schematic flowchart of the entire procedure.

**Experimental Setup**

Subjects sat on an isokinetic dynamometer (Humac Norm; CSMI, Stoughton, Massachusetts,) with the hip flexed to 90 degrees and the knee flexed to 60 degrees. The knee joint axis was aligned with the dynamometer axis. The trunk was stabilized with a shoulder harness and seat belts and the testing leg was stabilized with a thigh strap. The isometric knee extension contractions and the fatigue protocol were performed at 60-degree knee flexion. The analog IMVC torque data were collected by the isokinetic dynamometer, and signals were subsequently converted from voltage to newton meter for data analysis. The RPTD was defined as the time to reach peak torque (in kN·m/s) and was calculated from each trial as the slope of the torque–time curve, which was computed as the peak in knee extension torque divided by the time taken to reach peak torque.

Surface EMG activity of the VMO muscle was recorded using Ag/AgCl electrodes (3.5 × 2 cm; B&L Engineering, Santa Ana, California). To reduce skin impedance, the skin was shaved (if necessary), cleaned with alcohol, and lightly abraded with sandpaper. Conductive gel was then applied to the electrode. The electrode was positioned longitudinally along the VMO muscle, 4 cm superior and 3 cm medial to the superior-medial border of the patella (Figure 1). The EMG signals were preamplified (×330), band-pass filtered (10-3000 Hz), and sampled at a rate of 1000 Hz. The raw data were examined visually online and then AD converted for offline analysis. All signal processing was performed using the Labview software (Labview version 8.6; National Instruments Corporation, Austin, Texas). The root mean square of EMG was computed from the IMVC. Electromechanical delay (in milliseconds) was measured from the onset of the EMG of the VMO muscle signal to the onset of knee extension torque. The onset of EMG and torque production was defined as the time at which the EMG and force amplitude exceeded 3 SDs from the mean baseline activity.

**Experimental Procedures**

At baseline, subjects performed 4 maximal voluntary isometric knee extensions of 5-second duration each as fast as possible, with 10 seconds of rest between each contraction. This procedure was repeated after the taping application and then immediately and 5 and 10 minutes after the isometric fatigue protocol.

The isometric fatigue protocol was performed after the taping application. Subjects were asked to sustain a maximum isometric knee extension at full effort until the torque fell by 30% of the average IMVC. This exhaustive contraction induces quadriceps muscle fatigue.²² The subjects were given standardized verbal encouragement by the investigator throughout the fatigue protocol.

**Statistical Analysis**

Comparisons of baseline demographics were performed using independent t tests and χ² tests. Two-way mixed repeated measures analyses of variances were performed to examine the differences between groups with respect to time for the peak torque, RPTD, EMD, and rms-EMG. Post hoc pairwise comparisons were conducted. The level of significance was set to P < 0.05 for all tests. All analyses were conducted using the Statistical Package for the Social Sciences (SPSS) Software (version 11.1; SPSS, Inc, Chicago, Illinois).

**RESULTS**

Before the main study, a pilot study on 5 subjects was conducted to assess the reliability and repeatability of the measurements. Intraclass correlation coefficient (ICC) was conducted and the results showed satisfactory reliability of the isometric peak torque (ICC₃,₃ = 1.00), EMD (ICC₃,₃ = 0.98), and rms-EMG (ICC₃,₃ = 0.99).

All subjects (n = 26) completed the study. Table 1 shows the demographic characteristics of these subjects.
There were no statistically significant differences in baseline characteristics between the intervention and control groups. Table 2 shows the changes in the isometric peak torque, RPTD, EMD, and rms-EMG, before and after the tape application, and immediately, 5 minutes, and 10 minutes after the fatigue protocol. Figure 3 shows traces of typical force, RPTD, EMD, and rms-EMG, before and after the tape application.

### Isometric Peak Torque

Mauchly test indicated that the assumption of sphericity had been violated ($\chi^2 = 31.35$, df = 9, $P < 0.001$); therefore, the degrees of freedom were corrected using Greenhouse–Geisser estimates of sphericity. A significant time effect on the peak torque was found in both the intervention and control groups ($F_{(2.73,65.44)} = 24.5, P < 0.001$). A significant reduction in peak torque was found in both the intervention ($F_{1,12} = 42.16, P < 0.001$) and control ($F_{1,12} = 18.79, P < 0.001$) groups following the fatigue protocol. Both groups demonstrated a significant recovery of the peak torque 5 minutes after the fatigue protocol ($143.68 \pm 55.61$ N·m vs 117.14 $\pm$ 39.18 N·m, $F_{1,12} = 21.38, P < 0.001$; 126.32 $\pm$ 33.23 N·m vs 107.10 $\pm$ 27.87 N·m, $F_{1,12} = 32.53, P < 0.01$). The intervention group demonstrated a further significant recovery of the peak torque after 10 minutes ($149.48 \pm 60.20$ N·m vs 117.14 $\pm$ 39.18 N·m, $F_{1,12} = 23.30, P < 0.001$; 143.68 $\pm$ 55.61 N·m vs 149.48 $\pm$ 60.20 N·m, $F_{1,12} = 4.83, P = 0.04$). However, no significant group ($F_{2.73,65.44} = 2.13, P = 0.11$) or time $\times$ group interaction ($F_{1,24} = 0.59, P = 0.45$) effect on the peak torque performance was found.

### Rate of Peak Torque Development

A significant time ($F_{2.52,60.14} = 3.75, P = 0.02$) and time $\times$ group interaction ($F_{1,24} = 4.59, P = 0.04$) effect was found on the RPTD. Post hoc comparisons revealed significantly higher rates in the intervention group ($F_{1,24} = 4.59$, $P = 0.04$) over all 5 tests. Recovery measures immediately and 5 and 10 minutes after the fatigue protocol were significantly higher in the intervention group compared with the control group ($1.12 \pm 0.49$ kN·m/s vs 0.73 $\pm$ 0.41 kN·m/s, $F_{1,24} = 4.92, P = 0.04$; 1.34 $\pm$ 0.69 kN·m/s vs 0.86 $\pm$ 0.42 kN·m/s, $F_{1,24} = 4.59, P = 0.04$; 1.37 $\pm$ 0.63 kN·m/s vs 1.13 $\pm$ 0.57 kN·m/s, $F_{1,24} = 5.51, P = 0.027$), respectively.

### Electromechanical Delay and Root Mean Square of Electromyography

There were no significant time ($F_{4.96} = 0.88, P = 0.48$; $F_{2.56,61.4} = 2.75, P = 0.06$), group ($F_{4.96} = 0.56, P = 0.69$; $F_{2.56,61.4} = 1.16, P = 0.33$), or interaction ($F_{1,24} = 2.77, P = 0.11$; $F_{1,24} = 0.20, P = 0.66$) effects for the EMD or rms-EMG values, respectively.

### DISCUSSION

This study investigated the effect of KT on the neuromuscular performance of the knee extensor before and after an exhaustive isometric knee extension exercise. In the present study, application of the KT muscle facilitation method to the VMO did not improve the peak torque or the EMG activity during isometric knee extension. The VMO

### TABLE 1. Baseline Characteristics of the Subjects

<table>
<thead>
<tr>
<th>Intervention Group (n = 13)</th>
<th>Control Group (n = 13)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>22.62 ± 2.931</td>
<td></td>
</tr>
<tr>
<td>Female (%)</td>
<td>8 (61.5)</td>
<td></td>
</tr>
<tr>
<td>Male (%)</td>
<td>5 (38.5)</td>
<td>0.239</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>60.59 ± 9.30</td>
<td>0.870</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>166.70 ± 0.07</td>
<td>0.946</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>22.00 ± 3.21</td>
<td>0.870</td>
</tr>
<tr>
<td>Exercise frequency</td>
<td>0.368</td>
<td></td>
</tr>
<tr>
<td>0-1 time/wk</td>
<td>4 (30.8%)</td>
<td></td>
</tr>
<tr>
<td>2-3 times/wk</td>
<td>9 (69.2%)</td>
<td></td>
</tr>
<tr>
<td>≥3 times/wk</td>
<td>0</td>
<td>1 (7.7%)</td>
</tr>
</tbody>
</table>

All values are reported as mean ± SD unless otherwise indicated.

### TABLE 2. Changes in the Isometric Peak Torque, the Rate of Peak Torque Development, EMD, and rms-EMG of the VMO Before and After the Tape Application, and Immediately, 5 Minutes, and 10 Minutes After the Fatigue Protocol

<table>
<thead>
<tr>
<th>IPT (N·m)</th>
<th>Before Taping (Mean ± SD)</th>
<th>After Taping (Mean ± SD)</th>
<th>Postfatigue Protocol (Mean ± SD)</th>
<th>5-Minute Postfatigue (Mean ± SD)</th>
<th>10-Minute Postfatigue (Mean ± SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>KT group</td>
<td>142.71 ± 45.13</td>
<td>146.43 ± 55.38</td>
<td>117.14 ± 39.18</td>
<td>143.68 ± 55.61</td>
<td>149.48 ± 60.20</td>
</tr>
<tr>
<td>Sham group</td>
<td>136.75 ± 40.50</td>
<td>138.69 ± 37.21</td>
<td>107.10 ± 27.87</td>
<td>126.32 ± 33.23</td>
<td>126.29 ± 35.77</td>
</tr>
<tr>
<td>RPTD (kN·m/s)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>KT group</td>
<td>1.277 ± 0.554</td>
<td>1.344 ± 0.631</td>
<td>1.115 ± 0.486</td>
<td>1.344 ± 0.692</td>
<td>1.371 ± 0.630</td>
</tr>
<tr>
<td>Sham group</td>
<td>1.049 ± 0.508</td>
<td>0.977 ± 0.398</td>
<td>0.722 ± 0.414</td>
<td>0.864 ± 0.418</td>
<td>1.132 ± 0.565</td>
</tr>
<tr>
<td>EMD (ms)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>KT group</td>
<td>36.46 ± 12.24</td>
<td>33.31 ± 12.86</td>
<td>35.97 ± 14.75</td>
<td>34.87 ± 15.01</td>
<td>34.35 ± 10.97</td>
</tr>
<tr>
<td>Sham group</td>
<td>42.64 ± 25.46</td>
<td>42.15 ± 18.27</td>
<td>50.46 ± 27.59</td>
<td>48.64 ± 27.37</td>
<td>41.67 ± 19.26</td>
</tr>
<tr>
<td>EMG (mV)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>KT group</td>
<td>0.094 ± 0.049</td>
<td>0.105 ± 0.703</td>
<td>0.088 ± 0.044</td>
<td>0.104 ± 0.071</td>
<td>0.116 ± 0.077</td>
</tr>
<tr>
<td>Sham group</td>
<td>0.094 ± 0.433</td>
<td>0.096 ± 0.384</td>
<td>0.087 ± 0.034</td>
<td>0.099 ± 0.038</td>
<td>0.094 ± 0.038</td>
</tr>
</tbody>
</table>

IPT, isometric peak extension knee torque; EMG, rms-EMG of the VMO.
FIGURE 3. A typical tracing of the force, EMG, and EMD data.

muscle has been proposed as the key component in the maintenance of patella alignment during knee excursion. This assertion has been based on knee joint muscle morphology and/or neuromuscular perspectives. Because of the muscle attachment at 40 to 55 degrees to the long axis of the femur, the VMO contributes about 25% of the knee extensor force,23 counteracts the lateral pull of the patella, and provides stabilization of the knee in extension.24–27 Patellofemoral joint dysfunction is a common cause of anterior knee pain and has been frequently associated with weakness of the VMO to counteract the strong lateral pull.28 Therefore, KT enhancement of VMO performance may counteract the strong lateral pull, particularly in the final 20 to 30 degrees of knee extension. However, our results suggest that KT does not enhance VMO performance in healthy subjects, which agrees with other investigators who have shown no increase in isometric muscle strength after KT application.10,16 Chang et al16 found no significant difference in the maximal wrist flexor strength among 10 baseball players who received either KT, placebo tape, or no tape. Hsu et al10 also found no significant increase in lower trapezius muscle strength after KT or placebo tape application in 17 baseball players with shoulder impingement. Only the study by Lee et al11 has reported a positive acute effect of KT on isometric muscle strength. In that study, the handgrip strength of the dominant hand was compared in the neutral position, with the head and neck rotated to the non-dominant side, and with KT applied to the flexor capri ulnaris, flexor capri radialis, and biceps brachii muscles in 20 male and 20 female subjects, and a significant increase in the handgrip strength was found with KT application. However, no control or placebo group was included in that study.

The literature reports mixed results on the acute effects of KT on dynamic muscle action. Vithoulka et al12 and Fratocchi et al19 showed an increase in concentric elbow flexor peak torque and eccentric knee extensor peak torque after KT application. However, Fu et al13 and Vercelli et al15 reported that KT application did not produce any acute increase in concentric knee extensor torque during an isometric condition. The mode of muscle testing may therefore account for the observed differences between isometric and isokinetic conditions. If the main effect of KT is to facilitate the muscle spindle reflex through the recoil effect, then the stretching of KT to the underlying mechanoreceptors is necessary to facilitate the muscle contraction. In the present study, the peak torque is evaluated during isometric contraction, which resulted in minimal tape stretching compared with dynamic contraction. Therefore, reducing the KT recoil reflex muscle facilitation mechanisms may reduce the effect on muscle torque generation.

Similar to the acute effect, the KT does not improve the recovery rate of the isometric peak torque following a fatigue protocol. However, our results indicated that KT facilitated a higher rate of peak torque development compared with the control group immediately after and 5 and 10 minutes after the fatigue protocol. The underlying physiological mechanism may be related to the cutaneous stimulation of the skin mechanoreceptor by the KT application. Peripheral nerve stimulation caused by KT reduces the threshold of the motor neuron,17 and promotes both muscle spindle reflex contraction of the applied muscle36 as well as excitation of the motor cortex.31 These changes may therefore facilitate the recruitment of motor units. Several studies have investigated the effects of KT on motor unit recruitment. Slupik et al17 applied KT to the quadriceps muscle and evaluated EMG activity 10 minutes, 24 hours, 72 hours, and 96 hours after application. The results suggested that KT increases the EMG activity of the quadriceps muscle 24 hours after application, but no immediate effect on EMG activity. Hsu et al10 reported that KT compared with placebo tape increased lower trapezius muscle activity in the 60-degree to 30-degree arm-lowering phase in baseball players with shoulder impingement. Huang et al28 evaluated the effect of KT on triceps surae activity and vertical jump performance and found that KT enhanced the EMG activity of the medial gastrocnemius muscle but did not improve jumping height. However, Lins et al14 applied KT over the rectus femoris, vastus lateralis (VL), and vastus medialis muscles to the dominant leg of 20 asymptomatic subjects and found no significant differences in the rms-EMG of VL during concentric and eccentric knee extension peak torque among the KT, control, and placebo groups. Similarly, our present study did not show a significant enhancement of VMO recruitment with KT. Nonetheless, we take note that the subject population of our present investigation, Huang et al,12 and Lins et al14 are from asymptomatic subjects,
whereas the positive results from Hsu et al. are from symptomatic subjects. Thus, we are not sure whether KT will alter the motor recruitment in symptomatic cases.

The time interval between the onset of the EMG signal and the mechanical force production is defined as the EMD. This interval corresponds to the time needed for the contractile component in the muscle–tendon complex to initiate stretching of the elastic component series, and its duration is related to the mechanical properties of the elastic component series. Electromechanical delay has been shown to be affected by muscle fatigue and muscle length. One hypothesis is that KT alters the length–tension relationships of muscles through its elastic recoil effect to take up the slack of the muscle–tendon complex and decrease the onset time between motor unit activation and force generation. However, the present results showed no significant changes in the EMD of the VMO at any time immediately or 5 and 10 minutes after an exhaustive isometric knee extension exercise, and therefore do not support this mechanism. Similarly, Ng et al. also demonstrated that the EMD of the VMO muscle was not significantly different between a rigid taping group and a control group after fatigue of the quadriceps muscle. However, the present study did not test whether KT affects the EMD during a dynamic muscle contraction.

The present investigation evaluated one of the claimed beneficial effects of KT, improving muscle performance. This beneficial effect is presumably one of the reasons why the KT application is so popular in the athletic population. Our results concurred with one recent literature review that the KT might have a small beneficial role in muscle strength. Willis et al. conclusion is based on the analysis of 10 studies on the effect of KT on muscle strength. Among them, 4 studies reported positive outcomes on muscle strength performance. The authors therefore concluded that KT has a small but beneficial effect on strength performance. Another recent review evaluated the effect KT on pathological disorder. Among the 9 studies on musculoskeletal disorders, 2 studies assessed the change in muscle performance after KT application in Achilles tendinopathy and patellofemoral joint pain cases. The results indicated no changes in the hop test for the subjects with Achilles tendinopathy, and improvement in quadriceps strength for the patellofemoral joint pain patients. However, a recent study indicated that KT is effective in alleviating the pain during stair climbing activities in anterior knee pain patient. Thus, the possible beneficial role of KT, if any, to the patient population warrants further investigation.

Limitations

The present investigation studied the acute effect of KT on knee extensor performance in young healthy adults. The results of the findings had to be exercised with caution if it is interpreted to the athletic and injured population. The fatiguing protocol that we used in the present investigation is in the form of sustained maximum isometric contraction. This form fatiguing protocol is easy to monitor in experimental condition. Nonetheless, we take note that this kind of sustained maximum isometric contraction is not commonly occurred in athletic situation. The present investigation only evaluated the muscle facilitating technique accordingly to the KT methods suggested by the developer. As there are similar types of elastic type available in the market, we are not sure if similar findings will result with different types of elastic types.

Future Research

Despite the popularity of the application of KT in the sports community, the scientific evidence is still conflicting. Indeed, the recent 2 literature review on the effects of KT application all points to the direction on the need of more well-designed evidence-based studies. Moreover, studies should also be focused to the claimed physiological and therapeutic effect of the KT application. For instance, the KT method has been theorized to either facilitate or inhibit muscle movement. If the application of KT does act by causing a change of afferent input, then motoneuron excitability should be affected. Thus, the monosynaptic reflex of the muscle concerned should also be tested.

CONCLUSIONS

The results of the present study suggest that the KT muscle facilitating technique does not enhance the isometric peak torque or EMG activity during acute activation of knee extension, and does not enhance recovery of the isometric peak torque following a fatigue protocol. However, KT shortens the time required to generate the peak torque in knee extension. These results have important implications for sports performances that require the rapid generation of peak muscular force.

REFERENCES