Original Article

The effect of a vastus lateralis tape on muscle activity during stair climbing

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Abstract

Recently taping techniques with the primary purpose of altering muscle activity have become a part of clinical physiotherapy practice. A firmly applied tape across the fibres of the vastus lateralis (VL) muscle has been proposed to decrease the VL muscle activity. The primary aim of this study was to assess the effects of an inhibitory muscle tape applied over the vastus lateralis (VL) muscle during stair climbing. Twenty five subjects without lower limb pathology were recruited. Normalised integrated EMG (IEMG) was analysed from VL, vastus medialis obliquus (VMO), biceps femoris (BF) and soleus muscles during stair climbing. The subjects were assessed during three conditions: no tape (untaped), (no tension) control tape and (tensioned tape) VL inhibitory taping application. There was a significant decrease (p < 0.05) in the VL IEMG during the initial stance phase during both stair ascent and descent. The inhibition if the VL muscle occurred with both control and VL inhibitory tape applied. No significant differences (p > 0.05) were noted in any of the other muscles assessed. The results demonstrated that there was a significant decrease in the IEMG of the VL both during stair ascent and descent with VL inhibitory tape and control tape applied in normal subjects.

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Keywords: Tape; EMG; Muscle inhibition; Stair climbing

1. Introduction

The use of taping and strapping in injury management has been advocated for over a century. Gibney advocated what is now the most common taping technique, taping the ankle, as early as 1895 (Wilkerson, 2002). The use of tape as an adjunct to treating musculoskeletal and sports injuries has now become common practice.

The main body of research into tape applications has previously focused on techniques aiming to limit available joint movement. New taping applications with a primary purpose to increase or decrease a muscles’ activity pattern have recently emerged. It has been proposed that application of a tape parallel to the fibres of a muscle may increase the muscles’ activity and applying tape firmly perpendicular to the muscle fibres could inhibit the muscle (Morrissey, 2000). Despite the popular use of these techniques in clinical practice there is limited evidence.

A firmly applied rigid tape across the fibres of the vastus lateralis (VL) muscle has been proposed to decrease the VL muscle activity (Tobin and Robinson, 2000).

There is some evidence that an imbalance exists between the vastus medialis obliquus (VMO) and VL in patellofemoral pain (PFP) (Voight and Wieder, 1991; Cowan et al., 2001). The inhibitory taping application was originally designed to restore quadriceps muscle...
balance where VL was proposed to be overactive in relation to VMO among PFP patients (Tobin and Robinson, 2000). There are only two studies published on inhibitory taping of the VL and its effect on muscle activity both studies investigating surface EMG during stair descent (Tobin and Robinson, 2000; Janwantankul and Gaogasigam, 2005). The studies produced divergent results likely to be related to methodological issues. The two studies differ in terms of EMG sampling, processing and taping methods to a great extent. It is therefore difficult to draw direct comparisons and identify how this type of inhibitory tape affects the muscle activity. Previous descriptions of the methods of VL inhibitory tape applications are subjective and variable (Tobin and Robinson, 2000; Janwantankul and Gaogasigam, 2005). The previous studies on VL inhibitory tape analysed the mean EMG activity of the whole muscle activation envelope from one full stance phase during stair descent which did not allow for identification of pre- and post-foot contact muscle activation. (Tobin and Robinson, 2000; Janwantankul and Gaogasigam, 2005). The initial foot contact period has been not only considered an important phase in stair climbing as the greatest knee moments and patellofemoral joint forces occur at this stage (Costigan et al., 2002), but also for the consideration of vasti muscle onset activation in PFP (Gilleard et al., 1998; Cowan et al., 2002). For this study, it was therefore decided to analyse the initial activation period of muscle pre-contact activity and during the weight acceptance phase (McFadyen and Winter, 1988). The aim of this study was to assess the effects of a VL inhibitory tape application using a repeatable taping method, during controlled stair ascent and descent and performing appropriate EMG data collection and analysis. The null hypothesis was that there would be no difference in muscle activity between control tape VL inhibitory tape and a control condition during stair climbing.

2. Methods

2.1. Subjects

A total of 25 healthy volunteers (12 males and 13 females) were recruited between the ages of 19 and 39 (mean 25.8 ± 6.52). Subjects were included if they were aged between 18 and 45, had no previous lifetime history of knee pain, or quadriceps or hamstrings muscle pathology leading to consultation of a health professional. The subjects were excluded if they were unable to ascend or descend stairs, or had a history of an allergic reaction to zinc oxide tape. Informed written consent was received from each participant and an explanation of the study was given prior to the commencement of the study, which was approved by the University College Dublin Human Research Ethics Committee. The subject’s height, weight, body mass index and skin fold thickness were measured and calculated. Skin fold thickness was obtained from calliper (Harpenden, Burgess Hill, UK) measurements at four sites: biceps, triceps, subscapular and suprailiac.

The subjects were then allocated to a group of VL inhibitory tape first or control tape first by computer generated random allocation using SPSS (v 11.0) by an independent party. All subjects were tested without tape (control condition) initially prior to randomised tape application. The control condition was excluded from the randomisation process to minimise skin irritation. The subjects’ results were analysed across all three conditions.

2.2. Instrumentation

Surface EMG was gathered using pre-amplified EMG electrodes MA-317 (gain 300 ± 2%) (Motion lab systems, Baton Rouge, LA, USA) and the data were recorded on a Biopac MP 100A (Biopac Systems Inc., Santa Barbara, CA, USA). Measurement of foot contact on the step was performed using a heel and toe strike transducer (Biopac Systems Inc., Santa Barbara, CA, USA). The data were recorded on the Biopac MP 100. The data from EMG and heel and toe strike transducer was processed using its associated AcqKnowledge software (Version 3.5.7.).

2.3. Data acquisition

The surface EMG electrodes were applied over VMO, VL and biceps femoris (BF) muscles of the right limb. EMG was also sampled from the soleus muscle as a close relationship has previously been established between quadriceps and soleus in response to both cutaneous and nociceptive stimulation (Rossi and Decchi, 1995; Marque et al., 2001). The EMG activity of the biceps femoris was collected due to a previously suggested mechanism of quadriceps inhibition that may occur due to a withdrawal reflex. This reflex increases activation of the hamstrings muscle with a reciprocal inhibition of the quadriceps (Leroux et al., 1995). The electrodes were not removed or altered during the study between the different testing conditions.

For electrode placement of the VMO the electrode was placed 4 cm proximal to the medial superior corner of the patella and 3 cm medially at an angle of 55° to the line of the femur. The electrode for the VL was placed 10 cm proximal to the central patella in line with the femur and 6—7 cm laterally at an angle of 15°, both electrodes (Gilleard et al., 1998).

The biceps femoris placement was located on the midpoint on a line from the ischial tuberosity to the lateral tibial condyle and along the angle of that line with
the knee flexed less than 90° (SENIAM, 1999). The electrode for the soleus muscle was placed 3 cm proximal to the musculotendinous junction of the Achilles tendon bisecting the leg in line with the tibia (Hugon, 1973). The EMG was sampled at a rate of 2000 Hz. To decrease skin impedance, the skin was shaved, abraded using sandpaper and cleansed using an alcohol wipe. The electrodes were attached with adhesive tape. The data were recorded on the Biopac MP 100A. Heel and toe strike transducers (Biopac Systems Inc., Santa Barbara, CA, USA) were applied using adhesive tape, one under the calcaneus and the other underneath the metatarsal heads, both sensors placed lateral to the midline.

2.4. Procedure

The subject walked a set of three steps up and three steps down. Each step was 30 cm deep, 60 cm wide and the height of the step was 20 cm. The subjects stepped up with the left leg first followed by the right from which the data were collected. During stair descent the subject again initiated the gait with the left leg and data was collected from the following right leg. A metronome was used to standardise the pace of walking at 96 beats per minute (Cowan et al., 2000). Each subject was given as much time as was needed to get familiar with the stairs and the pace of walking prior to data collection. Data were collected during five trials of stair walking for each condition (untaped, VL inhibitory tape, control tape). Each trial of the raw EMG data was visually inspected for any evidence of baseline shift, motion artifact or mains interference. If any of the aforementioned were present, the trial was rejected. The three trials displaying the highest EMG collection quality were subsequently analysed.

The pressure sensitive heel and toe switches gave a recording of the contact from the forefoot and heel during the stair walking, detected by a spike or sudden deviation from the baseline. The time of impact was determined to within 0.5 ms and rounded to the nearest millisecond.

The skin was marked with two reference lines: (1) anterior superior iliac spine (ASIS) to the midpoint of the superior border of the patella; and (2) greater trochanter to the lateral femoral epicondyle. The midpoint was marked on each line. This area was shaved and wiped with alcohol. The subject was positioned on the side with a pillow between the knees, which were flexed to an angle of 30°.

Two lengths of flexible hypoallergenic tape, 5 cm in width, (Fixomull — Beiersdorf, Milton Keynes, UK) were applied superior and inferior to the previously marked midpoints of the reference lines extending past both lines by 2 cm. The control tape (flexible hypoallergenic tape) was laid on without any tension applied.

Three strips of 3.8 cm zinc oxide tape were applied with tension on top of the hypoallergenic tape from the anterior line extending over the lateral line (VL inhibitory tape). Tension was applied to the zinc oxide tape laterally and posteriorly with one hand. The lateral thigh tissues were collected with the other hand while applying a downward pressure with the thumb over the VL between the reference lines causing a furrow in the skin. The tension applied on the tape was standardised to cause a “skin roll” anterior and posterior to the thumb with the same height as the width (~20 mm) of the researchers thumb (McCarthy Persson et al., 2007). A total of three zinc oxide tape strips were applied, starting with the most superior tape above the midline mark, followed by the middle and finished with the distal tape, each overlapping the other by one-third of the tape width (Fig. 1). A 10-min period was kept between the taping conditions to minimise any possible carryover effect. Previous studies have found an immediate return to baseline muscle activity upon removal of tape (Alexander et al., 2003, 2008).

Any pain perceived from the application of tape during the stair walking was assessed directly after the trial using the visual analogue scale (VAS).

2.5. Data analysis

The raw EMG data (Fig. 2A) were band pass filtered (Blackman 61dB) at 20 Hz (low) and 500 Hz (high) (Fig. 2B). The data were thereafter full-wave rectified (Fig. 2C). The data were averaged over a 15-ms moving window (Fig. 2D) with a sampling rate of 2000 Hz, this equals 30 data points that slide one data point at a time (Swanik et al., 1999; Caulfield et al., 2004).

The data were exported to Microsoft Excel 2000. A macro was designed to extract EMG data from 500 ms pre-foot contact and 1000 ms post-contact both for stair ascent and descent and performing normalisation of the data. This time period included all EMG activity prior to foot contact and throughout the stance phase thus
allowing for analyses of selected time frames. It has been observed that the sensitivity of EMG testing can be improved if the average pattern of EMG for a specific functional activity can be constructed (ensemble-averaged profile) and the peak or mean from this pattern is used to normalise the amplitude of muscle activity (Yang and Winter, 1984; Swanik et al., 1999). Therefore the peak value of EMG in each control trial was identified and the mean of these three peak values was used to re-express all EMG records, thereby normalising all conditions with respect to the untaped condition. The mean of the three normalised EMG records for all conditions were subsequently calculated to provide a normalised ensemble averaged EMG for each condition (Caulfield et al., 2004). The area was calculated under the curve during the relevant time periods creating a Riemann integral (IEMG) (Hamill and Knutzen, 1995). IEMG has been recommended as the optimal method for quantifying muscle activation during kinesiological applications (SENIAM, 1999; Caulfield et al., 2004). Normalised IEMG can be expressed as a value that represents a percentage of peak activity related to the linear envelope (% ms).

The muscle activity was quantified by calculating the resulting normalised integral EMG activity at step-up and step-down during separate envelopes:

- 150 ms prior to impact to include the EMG pre-activation and 150 ms post impact to cover the first burst of stance phase EMG activity. This first burst of activity after foot contact was found to correspond to the initial weight acceptance phase.

The first period that was analysed therefore included all pre-contact motor activity, while the second period of muscle activation corresponded to the initial weight acceptance phase as described by McFadyen and Winter (1988).

As this taping procedure was designed for treatment of PFP, these periods are of particular clinical relevance. The initial period of the vastii muscle contraction has been one of the most researched due to the proposed alteration in onset of muscle activation in subjects with PFP (Voight and Wieder, 1991; Witvrouw et al., 1996; Gilleard et al., 1998; Cowan et al., 2001).

The time of impact was determined from the heel/toe strike transducers on the right foot during step up and step down to within 0.5 ms and rounded to the nearest millisecond.

3. Statistical analysis

Statistical analysis was carried out using Statistical Package for Social Sciences (SPSS) version 11.0 and Microsoft Excel 2000. The majority of the data were normally distributed as confirmed by the Kolmogorov-Smirnov test, thus allowing parametric tests to be employed. Where data were not normally distributed, non-parametric analyses were carried out. Repeated measures analysis of variance (ANOVA) was employed where the data was normally distributed to determine any differences between the untaped, VL inhibitory tape and control tape conditions for each muscle at 150 ms pre- and post-foot contact during stair ascent and descent. Where the data was not normally distributed, Friedman’s test was employed for non-parametric analysis. Post hoc analysis was carried out using paired t-test for parametric analysis. No post hoc analysis was carried out on non-parametric data due to non-significance of the initial analyses of these data sets. The level of significance was set at \( p < 0.05 \).

4. Results

The mean ± standard deviation (SD) height of the subjects was 1.72 ± 0.077 m, mean body mass
70.0 ± 9.25 kg, and the calculated body mass index 23.5 ± 2.76 kg/m². The mean (SD) skin fold thickness was 54.3 ± 28.33 mm.

4.1 Step-up

Analyses of the normalised IEMG (area underneath the rectified smoothed curve expressed in % · ms) of the VL, VMO, BF and soleus muscles revealed no significant difference in the pre-foot contact period during step-up across the three testing conditions (p > 0.05) (Table 1). A significant difference was found in the VL IEMG between the three testing conditions in the 150 ms period after foot contact during step-up (p = 0.002). Post hoc analysis of the step-up indicated that there was a significant decrease of VL IEMG with VL inhibitory tape applied compared to untaped (p = 0.027) and with control tape versus untaped (p = 0.001) (Table 1). No significant difference was found in IEMG of the other muscles (VMO, BF or soleus) assessed during step-up post-foot contact period (p > 0.05) (Table 1).

4.2 Step-down

Analysis of the normalised IEMG during the step-down of the VL, VMO, BF and soleus muscles revealed no significant difference between VL inhibitory tape, control tape and untaped in the 150 ms pre-foot contact period during step-down (p > 0.05) (Table 2). A significant difference was found in the VL IEMG between the untaped, VL inhibitory tape and control tape in the 150 ms period after foot contact during step-down (p = 0.003). Post hoc analysis revealed a significant decrease in IEMG of the VL during the 150 ms period post contact when the VL inhibitory tape (p = 0.002) and control tape (p = 0.005) were applied compared to the untaped condition (Table 2).

Table 1

<table>
<thead>
<tr>
<th></th>
<th>Untaped</th>
<th>VL inhibitory tape</th>
<th>Control tape</th>
<th>Statistical analysesa</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>150 ms pre</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VL</td>
<td>10.59 ± 5.854</td>
<td>10.25 ± 6.709</td>
<td>11.57 ± 12.057</td>
<td>p = 0.432b</td>
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<td>VMO</td>
<td>9.69 ± 4.155</td>
<td>9.58 ± 6.096</td>
<td>9.68 ± 5.129</td>
<td>p = 0.989</td>
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<td>BF</td>
<td>64.00 ± 50.370</td>
<td>60.46 ± 49.918</td>
<td>63.48 ± 59.092</td>
<td>p = 0.583</td>
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<td>Soleus</td>
<td>12.29 ± 7.778</td>
<td>9.94 ± 4.140</td>
<td>10.52 ± 4.751</td>
<td>p = 0.726</td>
<td>0.323</td>
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<tr>
<td>150 ms post</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>VL</td>
<td>143.19 ± 19.015</td>
<td>133.29 ± 29.069*</td>
<td>128.56 ± 21.013*</td>
<td>p = 0.002</td>
<td>7.226</td>
</tr>
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<td>VMO</td>
<td>143.50 ± 19.015</td>
<td>137.70 ± 31.033</td>
<td>135.17 ± 27.008</td>
<td>p = 0.094</td>
<td>2.484</td>
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<tr>
<td>BF</td>
<td>75.08 ± 50.875</td>
<td>69.49 ± 51.255</td>
<td>71.14 ± 54.535</td>
<td>p = 0.429</td>
<td>0.861</td>
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<td>Soleus</td>
<td>69.99 ± 28.627</td>
<td>54.61 ± 27.522</td>
<td>56.73 ± 25.927</td>
<td>p = 0.057</td>
<td>3.378</td>
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</table>

*Significant difference compared to untaped condition (p < 0.05).

a Repeated measures ANOVA unless other indicated.
b Friedman’s test.
c Chi square.

No significant difference was found in IEMG of the other muscles assessed (VMO, BF, soleus) during step-down post-foot contact period (p > 0.05)

There were no significant differences in IEMG between VL inhibitory tape and control tape during step-up or step-down (p > 0.05).

4.3 Pain assessment

All subjects subjectively experienced a strong pulling sensation from the VL inhibitory tape but not from the control tape. No subjects experienced pain as a result of the tape applications during the stair climbing (VAS = 0).

5. Discussion

The results of the study of EMG indicated that there was a significant decrease in the IEMG of the VL both
during stair ascent and descent with VL inhibitory and control tapes applied. This indicates that the proposed effects and the clinical use of the VL inhibitory taping are supported when applied in normal subjects, but also suggests that a non-rigid tape without the applied tension (control tape) has a similar effect. The VL inhibitory tape and control tape applications produced a decrease in the VL IEMG both during step-up and step-down, despite the differences in type of quadriceps muscle contraction. During stair ascent the hip and knee were in flexion at foot contact, the knee joint was extending and the quadriceps contracted concentrically (shortening of muscle). At foot contact during stair descent, the hip and knee was close to neutral, the knee joint was undergoing flexion and the quadriceps contracted during muscle lengthening (eccentric contraction).

The muscle inhibition occurring in the VL muscle only, demonstrated that the activity of VL could be selectively decreased relative to other parts of the quadriceps assessed, i.e. the VMO. It has previously been suggested that inhibition of the quadriceps muscle may be due to activation of a flexion withdrawal reflex (Leroux et al., 1995). The withdrawal reflex increases activation of the hamstrings muscle with a reciprocal inhibition of the quadriceps. In this study there was no statistically significant change in the biceps femoris IEMG in response to tape applied ($p > 0.05$), therefore this theory of quadriceps muscle inhibition does not seem likely in this case. There was no significant difference ($p > 0.05$) in pre-foot contact VL IEMG muscle activity during the selected 150-ms period during stair ascent or descent.

Tobin and Robinson (2000) detected a small non-significant increase in VL EMG in response to control tape. In the present study there was a decrease in EMG to both control tape and VL inhibitory tape. The differences in results between the previous study (Tobin and Robinson, 2000) and this study are difficult to explain, as the VL inhibitory tape led to a decrease in EMG in both studies but the control tape led to a different outcome. The method and site of tape application are the same in both studies except for the tension applied on the rigid tape which was not “measured” in the previous study. A possible reason for this disparity may be due to the differences in study methodology, tape tension and EMG data gathering and analysis as the control tape method and application site was the same in both studies. In the study by Janwantankul and Gaogasigam (2005), an elastic tape was applied parallel and perpendicular to the fibres of VL during stair descent. The study subjects descended a single step “staircase” and stepped backwards up again repeatedly without controlling the pace of gait and used non-normalised EMG data. Using non-normalised EMG data, no significant changes in mean EMG activity was noted.

It is possible that the taping method and EMG analysis may have affected the outcome as both Tobin and Robinson (2000) and the present study noted a decrease in the VL EMG activity.

<table>
<thead>
<tr>
<th></th>
<th>Untaped</th>
<th>VL inhibitory tape</th>
<th>Control tape</th>
<th>Statistical analyses$^a$</th>
<th>$F$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>150 ms pre</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>VL</td>
<td>38.45 ± 18.263</td>
<td>35.77 ± 21.579</td>
<td>36.69 ± 19.706</td>
<td>$p = 0.368$</td>
<td>1.02</td>
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<tr>
<td>VMO</td>
<td>31.09 ± 16.022</td>
<td>29.69 ± 17.96</td>
<td>31.42 ± 15.771</td>
<td>$p = 0.548$</td>
<td>0.46</td>
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<tr>
<td>BF</td>
<td>83.63 ± 58.515</td>
<td>85.07 ± 63.887</td>
<td>86.33 ± 61.972</td>
<td>$p = 0.801$</td>
<td>0.133</td>
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<tr>
<td>Soleus</td>
<td>27.09 ± 12.751</td>
<td>27.01 ± 13.349</td>
<td>27.53 ± 10.853</td>
<td>$p = 0.895$</td>
<td>0.058</td>
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<tr>
<td><strong>150 ms post</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VL</td>
<td>99.00 ± 36.543</td>
<td>88.47 ± 29.934*</td>
<td>89.01 ± 31.550*</td>
<td>$p = 0.003$</td>
<td>6.751</td>
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<td>VMO</td>
<td>93.35 ± 35.590</td>
<td>91.52 ± 34.731</td>
<td>87.77 ± 32.261</td>
<td>$p = 0.310$</td>
<td>1.202</td>
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<tr>
<td>BF</td>
<td>105.05 ± 58.714</td>
<td>107.53 ± 70.622</td>
<td>105.71 ± 70.743</td>
<td>$p = 0.838$</td>
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<td>Soleus</td>
<td>75.46 ± 23.965</td>
<td>73.52 ± 21.543</td>
<td>77.75 ± 20.430</td>
<td>$p = 0.572$</td>
<td>0.475</td>
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</table>

$^a$Significant difference compared to untaped condition ($p < 0.05$).

$^a$ Repeated measures ANOVA unless other indicated.

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**Table 2**
Step-down, means ± SD and analyses of the IEMG (% ms).

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**Fig. 4. Normalised group averaged mean EMG of the VL during step-down 150 ms pre- and post-foot contact.**
Tobin and Robinson (2000) postulated that the VL inhibitory tape might decrease the EMG activity, by stimulation of afferent C-fibres (nociceptive) causing descending alpha-motor neurone inhibition. This does not seem a likely mechanism in this study as no pain was experienced from either of the tapes applied over the muscle. The findings of this study noted similar effects on IEMG from both VL inhibitory tape and control tape. This evidence may indicate that the relatively large skin displacement occurring with the VL inhibitory tape is not necessary to alter muscle activity and kinematics in normal subjects. No apparent skin displacement occurred with the application control tape at rest, but it is possible that the change in IEMG could result from the contact of the tape on the skin. A tension of the cutaneous tissues may also have occurred from either tape of the applications during the activity of stair climbing. It has been demonstrated that stimulation of mechanoreceptors in the skin can modify effenter alfa-motor neurone activity (Garnett and Stephens, 1981). It has more recently been found that application of patella tape causing tension on the skin can modify the EMG activity of the VMO and that the motor changes were dependent on the direction of the tension applied (MacGregor et al., 2005).

There was no significant change in muscle activity from tape application in the pre-contact phase during these analyses. The pre-contact muscle activity of VL during the stair climbing was very low. It may be possible that the taping only affects the muscle activity during a relatively greater muscle activation such as during the weight acceptance phase.

The results of this study indicate that in subjects without knee pathology, the VL muscle can be selectively inhibited by tape applied on the muscle by VL inhibitory or control tape. The decrease in VL IEMG found in this study occurred during the initial weight acceptance phase as the foot comes in contact with the step and the weight is transferred through the lower limb. In the clinical setting VL inhibitory taping technique is used in subjects with patellofemoral pain syndrome (PFP) with a proposed relative increased activity of the VL in relation to the VMO muscle (Mariani and Caruso, 1979; Voight and Wieder, 1991; Thomee et al., 1995). This inhibitory effect of the VL, resulting from VL inhibitory tape and control tape, may be useful to address muscle imbalances in subjects with decreased activity of the VMO or increased activity of the VL.

Due to the normalising the EMG data to the control condition rather than a maximal voluntary contraction, it is not possible to quantify the amount of inhibition resulting from the tape applications. It is therefore difficult to draw conclusions in regards to if the reduction in muscle activity found in this study is clinically relevant. Therefore, future studies need to assess the effects of control tape and VL inhibitory in a patient group with altered vastii activation pattern or PFP.

6. Conclusion

This work demonstrates that VL inhibitory tape and control tape decrease EMG activity of the VL during stair climbing in normal subjects. The findings of this study noted similar effects on IEMG from both VL inhibitory tape and control tape. This evidence indicates that the large skin displacement occurring with the VL inhibitory tape is not necessary to alter muscle activity in normal subjects. Future studies are needed to assess the VL inhibitory and control taping techniques in subjects with PFP or abnormal quadriceps muscle activity.

References


