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Original article

The effects of Kinesio taping on muscle tone in healthy subjects: A double-blind, placebo-controlled crossover trial

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abstract

Kinesio taping (KT) has been proposed to modulate muscle tone. However no studies have systematically studied the efficacy of KTon this primary outcome measure. The objective of this study was to determine the effect of Kinesio taping (KT) applied over the gastrocnemius muscles on muscle tone, extensibility, elec-tromyography (EMG) and strength. Nineteen healthy subjects were enrolled in a double-blind, placebo-controlled crossover trial. KTand sham-tape were applied onto the gastrocnemius muscles of all subjects in two randomized sessions. Measurements before, at 10 min and 24 h after the intervention were taken. Outcome measurements included passive resistive torque to ankle dorsiflexion, dorsiflexion passive range of motion (PROM), surface Gastrocnemius Medialis (GM) EMG and maximal isometric voluntary force (MIVF). No significant differences were found between the sham-tape and KT groups for passive resistive torque, PROM nor maximal plantarflexion isometric voluntary force. A short-term increase of GM EMG activity was found in the KT group during the PROM mobilization, which was not maintained at 24 h following treatment. A short-term decrease in dorsiflexion force was produced 10 min after KT with respect to sham-tape application. These results demonstrate that the application of KT in the gastrocnemius muscles has no effect on healthy muscle tone, extensibility nor strength. However a short-term increase of GM EMG activity after KT treatment suggests the activation of central nervous system mechanisms, although without a therapeutic implication. Further studies with more appropriate designs are needed to clarify the physiological and therapeutic effects of this taping technique.

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1. Introduction

Kinesio taping (KT), developed by Kase (Kase et al., 1996), is a new application of adhesive taping. It is a thin elastic tape which can be stretched up to 130e140% of its original length and is applied over or around muscles to provide functional support (Kase et al., 1996; Kase, 1997). In the last few years the use of KT has extended among professionals, athletes and patients. However the specific effects and mechanisms of action of this kind of taping are still unknown. Although several studies have addressed the effects of KT on muscle strength, no effects have been identified in healthy subjects (Fu et al., 2008; Lins et al., 2012; Vercelli et al., 2012).

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Increase in electromyographic (EMG) activity has also been re-ported with KT (Slupik et al., 2007; Hsu et al., 2009) although this effect is not always clear (Huang et al., 2011; Lins et al., 2012). Range of motion increases statistically following KT treatment in subjects with several types of pain, without reaching clinical relevance (Thelen et al., 2008; Gonzalez-Iglesias et al., 2009; Castro-Sanchez et al., 2012). Taken together the equivocal results obtained measuring both EMG and range of motion suggests a need fully characterize the effect of KT on muscle tone in the context of muscle strength, muscle extensibility and evoked EMG activity.

The two main theories proposed to explain the reported func-tional effects of KT are increased blood and lymphatic fluid circu-lation in the taped area due to a lifting effect, which creates a wider space between the skin and the muscle and interstitial space (Halseth et al., 2004; Yoshida and Kahanov, 2007; Akbas et al., 2011). An additional theory is that KT may apply pressure or continual stretching of the skin within the taped area, and this external activation of cutaneous mechanoreceptors would activate modulatory mechanisms within the central nervous system demonstrated as an increase in muscle excitability (Yoshida and Kahanov, 2007; Akbas et al., 2011). Further studies are required to establish the role of these physiological mechanisms during KT on skeletal muscle tone.

Muscle tone is defined as “the state of activity or tension of a muscle beyond that related to its physical properties” (Stedman, 1982). Clinically muscle tone is accepted as the resistance felt to externally imposed movements during a state of voluntary relax-ation (Lance, 1980). Therefore in a completely relaxed subject, a joint will resist movement as a result of three physical processes:
(1) the inertia of the limb, (2) the viscoelastic properties of the muscle and joint opposing the movement and (3) evoked reflex activity (Pisano et al., 1996). According to these mechanisms skel-etal muscle tone reflects intrinsic viscoelastic muscle properties (also called “passive tone”, “mechanical”, “non-reflex” or “EMG-silent”) and neurogenic factors that are activated by stimuli, rep-resented mainly as the stretch reflex and also called “active tone”, “reflex tone” or “neurogenic tone” (Mirbagheri et al., 2001; Masi and Hannon, 2008). Both the viscoelastic and neurogenic compo-nents of muscle tone can be quantified separately by employing specific measurement techniques (Pisano et al., 1996; Lorentzen et al., 2010).

Several physical therapy techniques have been demonstrated to decrease muscle tone in healthy subjects, such as stretching and repetitive peripheral magnetic stimulation (McNair et al., 2001; Struppler et al., 2004). The main goal of this study was to assess whether KT would modulate muscle tone or other associated measures such as muscle extensibility, strength and evoked EMG activity. To achieve this goal a double-blind, crossover trial was designed including a masking technique so that subject and eval-uator were blinded to the application of either sham or active KT. Furthermore a battery of quantitative measures were used to demonstrate the potential effect of KT treatment on gastrocnemius muscle function.

2. Methods

2.1. Subjects

The study was approved by the Toledo Hospital Clinical Research Ethics Committee. Nineteen healthy volunteers (8 males and 11 females) with a mean age of 23.8 _ 3.9 years (accepted range 18e40), height of 168 _ 9 cm, weight of 65.8 _ 11.3 Kg and Body Mass Index of 23.2 _ 2.5 were recruited into the study following informed consent. Sample size was previously calculated based on McNair et al. (2001), which measured passive resistive torque to ankle dorsiflexion in healthy subjects using a Kin-Com dyna-mometer (McNair et al., 2001). The minimal number of subjects required to attain a power of 0.9 and an alpha level of 0.05 was calculated to be 11. Participants were recruited among students of the local University and Hospital staff, by non-probabilistic con-venience sampling. The exclusion criteria included any history of ipsilateral lower limb severe injury or intervention (e.g. fracture, surgical intervention.), pain or musculoskeletal injury in the previous month to the intervention, peripheral or central nervous system neurological disease, altered sensation within the taping area and changes in physical activity which would have affected muscle tone during the study.

2.2. Procedures

Initially, all volunteers were seated with the hip placed at a 90¯ position, with the knee straight and the ankle in a neutral position strapped to a footplate connected to a Kin-Com dynamometer (Chattanooga Group Inc.). Bipolar silver chloride coated surface electrodes (Delsys Inc. Signal Conditioning Electrodes v2.3, USA) were placed over the Tibialis Anterior and Gastrocnemius Medialis (GM) muscles by the non-blinded researcher according to the SENIAM protocol (www.seniam.org). A 2 cm^2 stainless steel ground electrode was placed over the patella.

At baseline (T0) the assessment consisted of a warm-up period, a passive resistive torque test at both slow (10¯/s) and fast (180¯/s) velocities, a passive range of motion (PROM) test and a maximal voluntary isometric force (MVIF) test (see below) for all subjects evaluated by the blinded evaluator. Concealed random allocation was performed to assign participants into the Sham-tape or KT arm during the first session. Tapes were applied to the subject in a prone position with the lower leg protruding from the bed by a physio-therapist with more than 20 years of KT application. Following application of the sham or active KT, the calf was covered by a non-compressive opaque fabric material. Subjects were instructed not to remove the cover during the study. This masking protocol effectively blinded both the evaluators and the subjects to the applied taping. Ten minutes after taping a second assessment was made (T1). To ensure the double-blind design, the non-blinded evaluator removed the cover material, placed the EMG electrodes and then re-covered the active or sham tapes before the T1 assessment. Finally a third assessment was made in the same way 24 h after initial taping (T2). The crossover study design was achieved by applying the sham or active KT treatment arm one week later.

2.3. Tape application

2.3.1. Kinesiotape

The Gastrocnemius muscle of the right leg was taped by an experienced physiotherapist (see above) according to Kenzo Kase's Kinesiotaping Manual (Kase et al., 1996; Kase, 1997) (Fig. 1A). The skin was cleaned and shaved and the Triceps Surae was stretched with the subject in the prone position with the lower leg protruding off the bed. In this position, the length of the tape strip of 5 cm width (CureTape , Fysiotape; Enschede, Netherlands) was measured from the proximal gastrocnemius muscle insertion to the calcaneus bone, including an additional 4 cm to enable the tape fixes properly to the heel. This strip was then cut longitudinally from the proximal extreme of the tape to the Triceps Surae myo-tendinous junction and was positioned directly on the skin without undue tension (100% of its maximum tape length) according to three phases: 1) the tape was anchored at the heel with the ankle joint in a neutral position, 2) Triceps Surae was stretched and 3) the divided proximal end of the tape was attached onto the medial and lateral heads of the gastrocnemius muscles.

2.3.2. Sham-tape

The sham-taping protocol consisted of placing three short strips of the same kind of material only onto the extremes of the KTapplication (heel, 12 cm) and medial/lateral heads of gastrocnemius muscles (5 cm), Fig. 1B). In this way, the sham-taping was made on the inef-fective parts of the triceps surae muscle without continuity, which is assumed not to have any effect (Karadag-Saygi et al., 2010). Further-more both types of taping had a similar appearance due to the coverof the non-compressive opaque material over the calf (Fig. 1C).

2.4. Assessment

2.4.1. Measurement of passive resistive torque

The measurement of the resistance to passive stretch using isokinetic dynamometric techniques is considered a valid method to measure muscle tone in non-injured subjects (Pisano et al.,

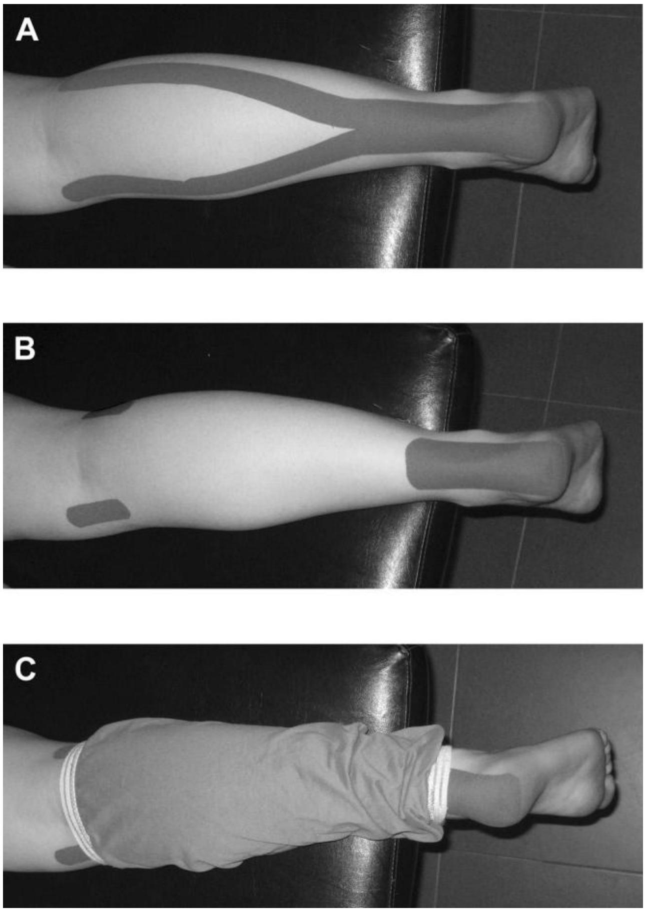

Fig. 1. Placement of the tape for both active and sham taping. A) Kinesio Taping placed on the Gastrocnenimus muscle according to Kase (Kase et al., 1996). B) Discontinuous sham-tape placed on ineffective parts of the muscles. C) Taping covered with a non-compressive opaque fabric material applied on top of either the active or sham tape conditions.

1996). Triceps Surae muscle tone was quantified by measuring the resistance to passive ankle dorsiflexion at slow (10¯/s) and fast (180¯/s) velocity. It has been evidenced that slow mobilizations expresses the non neural resistance to passive movement based principally on the mechanical elements of muscles, while fast mobilizations represents total muscle stiffness, including reflex-mediated resistance (Boiteau et al., 1995; Lamontagne et al., 1998). Volunteers performed a warm-up trial at each velocity to familiarize themselves with the protocol in a relaxed state. Subse-quently the subject's foot was moved from 35¯ plantarflexion to 10¯ dorsiflexion (Boiteau et al., 1995). Five repetitions were made for the 10¯/s movement velocity and a higher number of repetitions (10) were made for 180¯/s velocity due to an increase in the vari-ability of the passive resistive torque at faster velocities. Mean ankle dorsiflexion peak torque (Nm) was measured during slow and fast movement velocities as a variables of Gastrocnemius peak maximal muscle resistance. Mean integrated Gastrocnemius resistance (Nm.s) was calculated during passive ankle joint dorsiflexion, also during slow and fast stretch movement, to represent the energy needed to extend the muscles. In addition, evoked EMG activity was recorded during each stretch movement.

2.4.2. Measurement of gastrocnemius muscle extensibility

Muscle extensibility has been interpreted as a variable of muscle length and its ability to extend to a predetermined endpoint (Weppler and Magnusson, 2010). To ensure objective and independent quantification of the passive range of motion (PROM) for ankle dor-siflexion, the Kin-Com dynamometer was employed to perform a mobilization with the foot strapped to the footplate at a constant velocity of 10¯/s, from 35¯ ankle joint plantarflexion to maximum ankle dorsiflexion position. The maximum dorsiflexion angle was set as the position of the ankle at which the Gastrocnemius muscles generated a resistance of 200 N against the passive movement. Goniometric measurement of maximal ankle PROM, with the knee in full extension, has been considered to represent extensibility of the Gastrocnemius muscles (Grieve et al.,1978; Riener and Edrich, 1999). Subjects were instructed to press a panic button to stop the mobili-zation if they felt moderate pain, but no subjects stopped the controlled movement. In this way, all participants were mobilized with the same velocity and at the same strength. Gastrocnemius EMG was recorded during the last second ankle joint dorsiflexion in order to standardize its measurement in all subjects.

2.4.3. Maximal voluntary isometric force (MVIF)

The subject's foot was fixed at 5 degrees of plantarflexion in a foot plate connected to the dynamometer. Subjects performed two trials of ankle plantarflexion and another two trials for ankle dor-siflexion. Each trial consisted of a 3 s isometric MVIF with a 20 s period of rest between trials. Mean peak force was calculated for plantarflexion and dorsiflexion MVIF. Tibialis Anterior and Gastro-cnemious Medialis EMG activity were recorded during maximal isometric dorsiflexion and plantarflexion activation, respectively.

A pilot study was performed with 20 subjects in order to assess variables reliability. Three measurements were recorded for each outcome to calculate the Intraclass Correlation Coefficient (ICC) and the standard error expressed as the coefficient of variation (CV). The variables registered with the Kin-Com showed an ICC between 0.88 for passive muscle torque at 180 ¯/s (CV ¼ 10.3%) and 0.97 for gastrocnemius muscle extensibility (CV ¼ 1%).

2.5. Muscle EMG activity

Surface EMG was recorded at a gain of 1 KHz with an in-built filter bandwidth between 20 and 450 Hz. Electromyographic data were collected via an analogical-digital converter (Micro 1401-3; Cambridge Electronic Devices, CED, Cambridge, UK) and further off-line analysis was made with the Spike 2 software package (version 5.03, Cambridge Electronic Devices, CED, Cambridge, UK). EMG data were rectified, averaged and integrated for each contraction. Electromyographic activity recorded during maximal isometric ankle plantarflexion and dorsiflexion were calculated in units of mV ms. Gastrocnemius Medialis EMG activity recorded during slow and fast passive ankle dorsiflexion, and during the measurement of muscle extensibility were normalized as a percentage of the maximal isometric plantarflexion activation level.

2.6. Statistical analysis

SPSS v. 17.0 program (SPSS Inc., USA) was used to perform the statistical calculations. A two-way ANOVA (3 _ 2) for repeated measures was used as the inferential test, with the first factor representing the moment of testing (T0, T1 and T2) and the second factor the type of taping application (sham-tape or KT). To account for multiple comparisons, the Bonferroni multiple comparison test was performed. The criterion for statistical significance was set at $p < 0.05$. All the data are presented as mean _ standard deviation.

3. Results

The effect of KT on passive resistive torque to ankle dorsiflexion at 10 ¯/s and 180 ¯/s velocities are shown in Table 1. No significant differences were found for resistive passive torque to ankle dorsi-flexion at either 10 ¯/s or 180 ¯/s, between time interaction nor between the two conditions analyzed.

Ankle dorsiflexion PROM data are presented documented in Table 2. A significant difference ($p < 0.05$) was found for the KT condition, where integrated GM EMG activity was 5.6 _ 6.6% higher in T1 rather than T0 (95% Confidence Interval: 0.93e10.28%). No significant differences were found for the other measurements.

Measurements for MVIF are detailed in Table 3. No significant statistical interaction between group and time was identified for MVIF. A significant difference ($p < 0.05$) was identified after application of the KT (T1) for dorsiflexion peak force when compared to the sham group. Specifically peak force was 6.28 _ 10.67 N lower following KT treatment when compared to the sham treatment (95% Confidence Interval: 0.79e11.77 N), however this difference may have no clinical relevance. No signif-icant differences were found for the other MVIF test variables.

4. Discussion

This is the first time that a double-blind controlled crossover trial has been applied to measure the possible effect of KT treat-ment on muscle tone. As such the results of our study are inter-esting in that absence of change in passive resistive torque and GM muscle extensibility following KT contrast with the hypothesis proposed by Kase (Kase et al.,1996; Kase,1997), suggesting that this treatment may regulate muscle tone. Furthermore absence of change of viscoelastic or neurogenic muscle tone components following KT, indirectly measured following slow and fast move-ment velocities suggest that the mechanisms that have been pro-posed to mediate the effect of this treatment on muscle extensibility (Akbas et al., 2011) and EMG activity (Slupik et al., 2007) are not clear. However a short-term increase of GM EMG activity was found in the KT group during the PROM mobilization combined with a decrease in dorsiflexion force respect to sham-tape application, which was not maintained at 24 h following treatment. The fact that this study was performed in healthy sub-jects may have minimized the expected therapeutic effect of KT described in other studies (Gonzalez-Iglesias et al., 2009; Castro-Sanchez et al., 2012). Future studies should be designed in sub-jects with muscle tone pathologies such as spasticity, muscle contracture or hypotonia. Moreover other physical therapy tech-niques such as joint mobilization (McNair et al., 2001) and repeti-tive magnetic stimulation (Struppler et al., 2004) have also been demonstrated to produce significant effects in healthy subjects.

Increase of GM EMG activity with KT identified during the last second before the stretching peak might suggest the implication of short-term central neuronal control mechanisms. Other studies have demonstrated an increase in EMG activity following KT

Table 2

Effect of KT on maximal passive range of motion (PROM) for ankle dorsiflexion. Neutral position was set at 90¯. Abbreviations: PROM: Passive range of motion; KT: Kinesiotape; GM: Gastrocnemius Medialis; MVC: Maximal voluntary contraction*: difference P < 0.05 compared to T0. Data expressed as mean _ SD.

Measure	Group	T0	T1	T2
PROM (¯)	Sham	115.8 _ 10.9	117.2 _ 10.0	116.6 _ 10.6
	KT	116.2 _ 10.0	115.9 _ 10.5	116.0 _ 9.6
Integrated GM EMG normalized as plantarflexion MVC (%)	Sham	27.0 _ 24.2	23.0 _ 16.8	24.2 _ 26.4
	KT	21.6 _ 11.4	27.2 _ 14.7*	26.6 _ 18.4

measured with several testing conditions and in different pathol-ogies (Slupik et al., 2007; Hsu et al., 2009; Huang et al., 2011; Konishi, 2013). These effects have been explained by central ner-vous system neuromodulation promoted by activation of cutaneous mechanoreceptors (Yoshida and Kahanov, 2007; Akbas et al., 2011), including the implication of muscle Ia afferents (Konishi, 2013). However absence of change of passive resistive torque in response to movement velocity suggests that potential mechanical sensory input generated by KT may not be strong enough to influence muscle mechanics. According to this hypothesis Wong et al. showed an increase of muscle recruitment demonstrated as a shorter time to peak extension torque, but without effect on torque itself (Wong et al., 2012).

The present study failed to identify an effect of KT on muscle extensibility. Previous studies using PROM measures demonstrated a lengthening effect of KT on axial musculature in patients with associated pain pathologies, such as low back pain or acute whip-lash injury (Gonzalez-Iglesias et al., 2009; Castro-Sanchez et al., 2012). In addition Yoshida et al. found an increase in trunk flexion range of movement but not in either trunk extension or lateral flexion in healthy subjects (Yoshida and Kahanov, 2007). In contrast an increase in PROM was found in lower (Akbas et al., 2011) and upper limb (Thelen et al., 2008; Hsu et al., 2009) after osteoarticular pathologies, but no studies have been performed in healthy subjects.

With respect to muscle strength, the results of this study with KT agree with most of the other studies showing no change in healthy subjects (Fu et al., 2008; Chang et al., 2012; Lins et al., 2012; Vercelli et al., 2012; Wong et al., 2012). However some studies have found an increase in muscle strength during eccentric isokinetic muscle contraction (Vithoulka et al., 2010; Fratocchi et al., 2013), which suggests that KT could play a major role dur-ing functional contractions, although the effect of this treatment on muscle performance during different tasks is also controversial (Huang et al., 2011; Bicici et al., 2012; Karatas et al., 2012; Lins et al., 2012). Even though the results obtained in this study may

Table 1

Effect of KT on passive resistive torque to ankle dorsiflexion at slow and fast velocities. Data expressed as mean _ SD. Differences in T1 and T2 from T0 were expressed as percentage (T0 ¼ 100%). Abbreviations: KT: Kinesiotape; GM: Gastrocnemius Medialis; MVC: maximal voluntary contraction.

Velocity	Outcome	Group	T0	T1	T2
10 ¯/s	Peak force (N)	Sham	67.4 _ 24.8	68.7 _ 23.9 (101.9%)	66.0 _ 23.5 (97.9%)
		KT	68.9 _ 24.2	68.5 _ 22.6 (99.4%)	68.4 _ 23.7 (99.3%)
	Integrated force (N s)	Sham	138.7 _ 40.3	138.3 _ 40.7 (99.7%)	135.4 _ 35.5 (97.6%)
		KT	147.7 _ 46.4	138.5 _ 34.8 (93.8%)	142.4 _ 39.4 (96.4%)
	Integrated GM EMG normalized from plantar flexion MVC (%)	Sham	24.2 _ 17.7	25.6 _ 21.4 (105.8%)	15.3 _ 13.4 (63.2%)
		KT	25.5 _ 18.2	24.3 _ 14.8 (95.3%)	20.9 _ 14.4 (82.0%)
180 ¯/s	Peak force (N)	Sham	50.2 _ 16.4	51.5 _ 18.4 (102.6%)	52.8 _ 21.8 (105.2%)
		KT	52.3 _ 15.5	48.7 _ 14.4 (93.1%)	53.3 _ 16.4 (101.9%)
	Integrated force (N s)	Sham	9.9 _ 2.9	9.9 _ 31 (100.0%)	10.2 _ 3.6 (103.0%)

	KT	10.3 _ 3.3	9.5 _ 2.8 (92.2%)	10.2 _ 2.9 (99.0%)
Integrated GM EMG normalized from plantar flexion MVC (%)	Sham	23.0 _ 16.7	23.7 _ 14.0 (103.0%)	20.00 _ 14.2 (86.9%)
	KT	21.5 _ 11.4	21.9 _ 12.7 (101.9%)	21.7 _ 13.0 (100.9%)

Table 3
Effect of KT on maximal voluntary isometric force (MVIF). Abbreviations: KT: Kinesiotape; GM: Gastrocnemius Medialis; TA:Tibialis Anterior.* : difference p < 0.05 compared to the sham group. Data expressed as mean SD.

ACTION	Outcome	Group	T0	T1	T2
PLANTARFLEXION	Peak force (N)	Sham	864.8 _ 327.1	867.9 _ 365.9	887.3 _ 325.3
		KT	829.8 _ 275.4	872.8 _ 326.4	893.0 _ 328.7
	Integrated GM EMG (mv.ms)	Sham	0.287 _ 0.139	0.297 _ 0.161	0.287 _ 0.127
		KT	0.278 _ 0.156	0.284 _ 0.158	0.308 _ 0.143
DORSIFLEXION	Peak force (N)	Sham	194.6 _ 56.6	192.4 _ 66.9	190.4 _ 73.7
		KT	185.3 _ 65.90	186.1 _ 64.3*	189.4 _ 73.6
	Integrated TA EMG (mv.ms)	Sham	0.483 _ 0.154	0.484 _ 0.188	0.432 _ 0.127
		KT	0.445 _ 0.190	0.432 _ 0.189	0.450 _ 0.176

not have a therapeutic impact, the effect of KT on lowering muscle strength in the antagonist muscle when compared with sham tape treatment is novel. Although this effect was not maintained up to 24 h, the short-term decrease in strength could be explained via modulatory mechanisms of spinal reciprocal inhibition. Specific neurophysiological studies should be made to determine this hypothesis.

The high variability of results found within several KT studies highlights the methodological problems associated with either the outcome measures or with the specific tested pathology. Only a few double-blinded trials have been performed to address the functional effect of taping (Thelen et al., 2008; Karadag-Saygi et al., 2010; Castro-Sanchez et al., 2012), most likely due to the difficulty in establishing an adequate sham-taping protocol, which would mask the treatment to both the subject and the evaluator. Many methods have been used to permit blinding with these techniques, such as alternative non-elastic materials (Hsu et al., 2009; Huang et al., 2011; Lins et al., 2012), application of the tape to different locations on ineffective parts of the muscles (Thelen et al., 2008; Karadag-Saygi et al., 2010) or changing the direction of the strips (Vithoulka et al., 2010; Castro-Sanchez et al., 2012). Physical differences between the appearance of the tape could also unmask the placebo effect. This was directly controlled in our study by using this new “covered-method” technique (see Fig. 1C). However this masking technique assumed that: (1) the sham-tape consisting in shorts strips located in the extreme of the muscle and, (2) the non-compressive cover used for masking both tapes would have no effect on the outcome measures. To confirm this assumption, future studies should include a no-tape group and a no-covered tape group, in order to establish a standardized testing methodology. In addition probabilistic recruitment methods should be applied to improve generalisability and external validity in future studies.

5. Conclusion

This is the first time that a potential KT effect has been evaluated specifically on muscle tone using an appropriate quantitative and objective methodology. Our findings demonstrate that the appli-cation of KT on the gastrocnemius muscles has no effect on healthy muscle tone, extensibility nor strength. However some short-term central mechanisms could be activated due to the increase of GM EMG during the last degrees of passive ankle joint dorsiflexion in combination with a decrease of ankle dorsiflexors strength which disappeared 24 h after KT application, although without thera-peutic relevance. The study design could also be applied to study the effect of KT on muscle tone that develop during pathologies such as contracture or spasticity, where the combination of both biomechanical and neurophysiological measurements are required to clarify the central effect of KT and its possible mode of action on muscle tone.

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