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SHORT REPORT

Effect of Kinesio taping on muscle strength in athletes—A pilot study

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Summary Muscle strength is a key component of an athlete's performance and may be influenced by taping. This study examined the possible immediate and delayed effects of Kinesio taping on muscle strength in quadriceps and hamstring when taping is applied to the anterior thigh of healthy young athletes. Fourteen healthy young athletes (seven males and seven females) free of knee problems were enrolled in this study. Muscle strength of the subject was assessed by the isokinetic dynamometer under three conditions: (1) without taping; (2) immediately after taping; (3) 12 h after taping with the tape remaining in situ. The result revealed no significant difference in muscle power among the three conditions. Kinesio taping on the anterior thigh neither decreased nor increased muscle strength in healthy non-injured young athletes.

Introduction

Kinesio tape, invented by Kenzo Kase in 1996, is a new application of adhesive taping. It is a thin and elastic tape which can be stretched up to 120—140% of its original length, making it quite elastic and resulting in less mechanism constraints, compared with conventional tape. Kinesio taping, an organised wrapping technique using Kinesio tape proposed by Kase, is claimed to be able to reduce pain, swelling and muscle spasms, as well as to prevent sport injury.[1]

Taping is widely used to prevent injury to athletes.[2] The therapeutic effects of knee taping include minimising pain, increasing muscle strength, improving gait pattern and enhancing functional outcome of patients with sports injury, osteoarthritis (OA) and patellofemoral pain (PFP).[3,4]

Taping may increase or reduce muscle strength, and many investigators' hypotheses to explain the possible underlying mechanism, including neurofacilitation and mechanical restraint (e.g., Macgregor et al.) have identified the relationship between cutaneous afferent stimulation and motor unit firing.[5] Conversely, Cools et al. observed no significant influence of tape on electromyography activity in the scapular muscles of healthy subjects.[2] How-

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ever, few studies have measured the effectiveness of Kinesio taping and these studies have obtained inconsistent results.[1,6] The main goal in this study is to answer the question whether muscle power could be changed by Kinesio taping. Hence, this study investigates the effects of Kinesio taping on muscle strength after application of taping on the anterior knee and thigh, and the immediate and delayed effects of Kinesio taping that may be relevant for clinical application.

Materials and methods

Subjects

The subjects were the college athletes of the Nation College of Physical Education and Sports majoring in kickboxing. Fourteen healthy athletes, seven males and seven females (mean age, 19.7 ± 1.0 years, mean body height 168.9 ± 6.1 cm, mean body weight 60.3 ± 8.2 kg), were enrolled in this study. Informed consent in accordance with institutional ethical standards of the ethics committee on human experimentation was obtained from each subject. Those who reported active knee pain, trauma in the lower limbs within the previous 3 months or any surgery history for the lower limbs were excluded.

Instrumentation

The Cybex NORM isokinetic dynamometer (Lumex Corporation, Ronkonloma, NY, USA) was adopted to assess concentric and eccentric muscle strength in the quadriceps and hamstring muscles while contracting at a speed of 60°/s and 180°/s.

Subjects were taped with a Y-shaped Kinesio tape at the quadriceps according to the Kenzo Kase's Kinesio taping manual (Kase et al., 1996)[7] by the same physician. The dominant side of the subjects' knees were taped. Fig. 1 illustrates the subjects' posture when Kinesio taping is being applied. The subjects lay in the supine position with the hip flexed at 30° and the knee flexed at 60°. The tape was applied from a point 10 cm inferior to the anterior superior iliac spine, bisected at the junction between quadriceps femoris tendon and the patella, and circled around the patella, ending at its inferior side. The first 5 cm of tape were not stretched and acted as the anchor. The portion between the anchor and superior patella was stretched to 120%. The remaining tape around the patella remained un-stretched.

Figure 1 The taping method and the subject's posture when applying Kinesio taping.

Test protocol

Taping conditions

Three taping conditions were applied to each subject: (1) without taping (WT); (2) immediately under taping (IT); (3) 12 h after taping and with the tape still in situ (AT). Subjects were assessed in each condition by three daily activities and muscle strength was measured by the isokinetic dynamometer.

The order of the three conditions was randomised using a random number allocation table. To avoid any bias resulting from muscle fatigue induced by the previous isokinetic assessments, the inter-assessment intervals were at least 7 days.

Isokinetic muscle strength

Muscle strength was evaluated using a Cybex NORM. Each subject was given verbal instructions to maximise effort and was allowed to see the monitor. The sequence of evaluation was as follows: concentric quadriceps contractions at 60°/s; eccentric quadriceps contractions at 60°/s; concentric quadriceps contractions at 180°/s and eccentric quadriceps contraction at 180°/s. The same testing protocol was repeated to test hamstring muscle strength.

Data analysis

Analysis by ANOVA for repeated measures (three conditions) was used to assess the effect of Kinesio taping on muscle strength. Main effect analysis was applied in cases of significant difference among the three assessments. Estimates of effect size were analysed using the partial eta-squared method to describe the proportion of total variability

Table 1 Comparison of peak torque, and total work of quadriceps and hamstring muscles, and functional activity among the three taping conditions

Concentric/eccentric	Velocity (°/s)	Contractor	Condition			*p*-Value	Effect size
			WT	IT	AT		
Peak torque (kg m)							
Concentric	60	Quadriceps	43.8 ± 13.4	40.9 ± 12.2	43.0 ± 12.3	0.323	0.083
Eccentric	60	Quadriceps	45.4 ± 16.1	43.4 ± 14.1	44.7 ± 14.6	0.597	0.039
Concentric	180	Quadriceps	33.2 ± 10.6	32.4 ± 12.0	36.4 ± 12.3	0.027[a]	0.242
Eccentric	180	Quadriceps	39.4 ± 13.6	37.9 ± 13.5	41.4 ± 13.8	0.194	0.119
Concentric	60	Hamstring	26.2 ± 10.3	25.3 ± 9.3	25.6 ± 8.2	0.568	0.043
Eccentric	60	Hamstring	25.3 ± 7.5	23.7 ± 7.1	24.0 ± 7.0	0.108	0.157
Concentric	180	Hamstring	23.7 ± 8.1	22.9 ± 7.5	22.2 ± 7.2	0.496	0.052
Eccentric	180	Hamstring	21.1 ± 6.8	19.5 ± 6.0	19.5 ± 6.1	0.194	0.119
Total work (kg m)							
Concentric	60	Quadriceps	27.4 ± 8.1	25.7 ± 6.9	26.1 ± 6.6	0.466	0.050
Eccentric	60	Quadriceps	28.0 ± 10.8	29.1 ± 12.3	29.3 ± 10.2	0.708	0.026
Concentric	180	Quadriceps	22.5 ± 6.2	21.2 ± 6.4	22.9 ± 6.1	0.330	0.082
Eccentric	180	Quadriceps	26.7 ± 8.9	28.2 ± 10.9	28.2 ± 8.4	0.571	0.033
Concentric	60	Hamstring	22.2 ± 9.5	21.7 ± 8.9	22.7 ± 8.4	0.474	0.056
Eccentric	60	Hamstring	18.9 ± 4.5	18.4 ± 4.8	19.1 ± 5.1	0.582	0.041
Concentric	180	Hamstring	21.2 ± 7.4	19.9 ± 6.6	20.6 ± 7.4	0.486	0.054
Eccentric	180	Hamstring	16.0 ± 4.0	15.6 ± 4.4	16.4 ± 4.0	0.382	0.071

WT: without taping; IT: immediately after taping; AT: 12 h after taping; ab: comparing WT and IT, bc: comparing IT and AT; ac: comparing AT and WT.

[a] Difference: AB, AC.

attributable to each factor. Statistical significance was set at $p < 0.05$.

Results

Two data were excluded from data analysis due to the subject's factor; final data for analysis consisted of seven males and seven females. All subjects were healthy athletes, and none complained of pain or discomfort during examination.

Evaluation of comparison of peak torque and total work of quadriceps and hamstring muscle by isokinetic assessments was shown in Table 1. The ANOVA for repeated measures for the three conditions indicated that WT had the lowest peak torque among the three conditions in concentric contraction of the quadriceps at 180°/s ($p < 0.05$). No significant differences existed among subjects in other assessments. Additionally, no significant interaction effect existed between conditions and assessments ($p > 0.05$).

Discussion

The results suggest that Kinesio taping does not enhance nor inhibit muscle strength when applied to the thighs and knees of healthy athletes. This finding is contrary to the claim that tape applied under tension in the direction of muscle fibres facilitates the strength of the underlying muscle.[8] However, this study obtained a result similar to that obtained by Janwantanakul,[9] who indicated that taping does not affect the muscle activities measured by electromyography. In this study, Kinesio taping applied to skin apparently provided tactile input. However, tactile input has been reported to interact with motor control by altering the excitability of the central neuron system.[10,11] The negative results observed in this study can be explained by the fact that tactile input generated by Kinesio taping may not be strong enough to modulate muscle power of healthy athletes.

This study does not support the existence of probable effects on muscle power induced by Kinesio taping. Both the target muscles for taping, the quadriceps, and the antagonist muscle, the hamstrings, were assessed. Kinesio taping did not generate any inhibition or facilitation in all tested muscles. The only significant difference observed for peak torque during concentric contraction of quadriceps at 180°/s can be explained as a type II error resulting from multiple comparisons.

To minimise the possible selection bias, we recruited the subjects with the same background,

the college athletes of the Nation College of Physical Education and Sports majoring in kickboxing. We supposed that a relatively homogeneous group would yield less variance in their performance, because they were majoring in the same subject and under the same training course.

In conclusion, Kinesio taping on the knee does not affect muscle performance of healthy young athletes. The effectiveness of Kinesio taping for pain relief, promotion of circulation and relief of muscle spasm need further investigation in acute injured athletes in the future.

Practical implications

- Kinesio taping neither decreases nor increases muscle power in uninjured athletes.
- The ineffectiveness of changing muscle power by Kinesio taping is observed immediately and 12 h after the application.
- The effect of Kinesio taping on muscle power of injured athletes has not been confirmed yet.

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