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Kinesio Taping and Jump Performance in Elite Female Track and Field Athletes

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Context: The application of kinesio tape (KT) to lower-extremity muscles as an ergogenic aid to improve muscle-strength-related parameters such as jumping is controversial. ***Objective:*** To test the hypothesis that the application of KT enhances the jumping performance of healthy uninjured elite female track and field athletes. ***Design:*** A double 1-legged jump test was performed before and after the application of blue K-Active tape without traction on the maximally stretched gastrocnemius, hamstrings, rectus femoris, and iliopsoas muscles according to the generally accepted technique. ***Participants:*** 18 German elite female track and field athletes (age 21 ± 2 y, height 172 ± 4 cm, body mass 62 ± 5 kg, active time in their sport 13 ± 4 y). ***Results:*** Factorial analysis of variance with repeated measures (ANOVA, Bonferroni) revealed no significant differences in jumping performance between the tests ($P > .05$, $d = 0.26$). ***Conclusions:*** These findings suggest that the application of KT has no influence on jumping performance in healthy, uninjured female elite athletes. The authors do not recommend the use of KT for the purpose of improving jump performance.

Keywords: muscle function, athletic training, strength

The application of kinesio tape (KT) to reduce pain and improve stability and proprioception in patients with patellar dislocation[1] and shoulder[2] and ankle pain,[3] as well as stroke and trunk dysfunction,[4,5] has become common practice in clinical settings. According to the gate-control theory proposed by Melzack and Wall,[6] the response to KT concerning pain relief may be explained by a decreased nociceptive input of skin, joints, and skeletal muscles by sensory stimulation of the skin. In addition to the cutaneomuscular stimulation, the application of KT is purported to provide continuous tension to the skin, which is transmitted to the skeletal-muscle fascia.[7] Lumbroso et al[8] proposed increased cutaneous tension from KT as a potential reason for increased strength of the gastrocnemius and hamstring muscles, as well as for improved range of motion of the knee and ankle.

Proprioceptive input[9] and muscle activation and strength[3,8,10,11] are important components of complex movements such as jumping.[12] Rousanoglou et al[12] reported a significant relation between jumping height and strength of the knee-extensor muscles in young female volleyball players (*P* £ .05 and power of analysis >.80). However, findings are conflicting regarding the effects of KT on muscle strength[11,13–15] and jumping,[11,16,17] with reported improvements in healthy participants[8,10,11,14] but not in athletes.[13,14] For instance, jump performance of healthy participants with no history of previous lower-extremity injuries was improved by using KT,[11] but this was not the case in male athletes.[17]

To date, no studies have investigated the impact of KT on jumping performance in elite female athletes. Since females differ from men in muscle and subcutaneous morphology, and jumping performance depends on the strength of the lower extremities[12] and KT influences strength properties by cutaneomuscular stimulation, it is reasonable to assume that KT, when used by healthy female athletes, may enhance jumping performance. The aim of the study was to test the hypothesis that the application of KT enhances jump performance of healthy elite female track and field athletes.

Methodology

Eighteen healthy, elite, uninjured female track and field athletes with expertise in long jump, sprint, and heptathlon participated in this study (age 21 ± 2 y, height 172 ± 4 cm, body mass 62 ± 5 kg, active time in their sport 13 ± 4 y). All athletes were members of the national or

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federal squads of Germany and regularly competed in international competitions. All were informed of the protocol and provided their written, informed consent to participate. All procedures were approved by the ethics committee and conducted in accordance with the Declaration of Helsinki.

Procedures

KT-experienced physiotherapists applied K-Active tape (blue color, K-Active, Wiesthal, Germany) on the participant's lower leg. One of the participant's legs was randomly selected for KT placement on the following muscles: gastrocnemius, hamstring, rectus femoris, and iliopsoas (Figure 1). KT was applied without traction on maximally stretched muscles from proximal to distal insertion according to the instructions developed by Kase for muscle-activation techniques.[18]

All participants were familiar with the exercise test used in this study, a double 1-legged jump test (Figure 2), as this was part of the regular testing procedures in their squads.

From the starting position—standing only on the test leg—all participants performed two 1-legged jumps with the same leg into a long-jump pit filled with sand.

Figure 1 — Kinesio taping of the right leg. Muscle-activation technique taped from origin to insertion of the treated muscles.

Jump performance was defined as the distance between the starting point and nearest mark in the sand and was measured in meters. For every test, 2 trials were conducted with both legs, in which one leg was the test leg with KT (TL) and the other leg was the control leg without KT (C). The average of all tests is reported. Each participant performed 3 tests (Figure 3). The first test without KT (T1) was performed after a standardized 30-minute moderate-intensity warm-up consisting of walking, jogging, running, and jumping exercises. The leg with which the test started was randomly selected and was maintained throughout all tests. Before the second test with KT (T2), all participants took a 15-minute break before the KT was applied and then performed another 30-minute moderate-intensity warm-up as described for T1. To control for a possible placebo effect, the KT was removed from the leg, and after a 5-minute rest period, the third test was performed without KT (T3).

Statistical Analyses

Data are expressed as mean values and standard deviations. All statistical analyses were performed with Statistica (version 6.0, StatSoft, Tulsa, OK). Factorial analysis of variance was used to assess statistical differences with repeated measures (ANOVA, Bonferroni). The significance level for all analyses was set at $P < .05$. The effect size, Cohen *d,* defined as (difference between the means)/SD, was calculated for all time points. The thresholds for small, moderate, and large effects were defined as 0.20, 0.50, and 0.80, respectively.[19]

Results

Before applying the KT, there were no significant differences in the jump performance between the TL and the C (TL1, 4.06 ± 0.18 m; C1, 4.07 ± 0.23 m) ($P > .05$). There were no significant changes in the TL or C after application of the KT (TL2, 4.13 ± 0.17 m; C2, 4.08 ± 0.21 m) either between the conditions or in comparison with the pretest values. Effect-size calculations showed a low to moderate effect between TL2 (4.13 ± 0.17 m) and C2 (4.08 ± 0.21 m) ($P > .05$, $d = 0.26$). There were no significant changes after removing the KT in the T3 placebo trial (4.13 ± 0.21 m vs 4.09 ± 0.22 m).

Figure 2 — Example or the double 1-legged jump test.

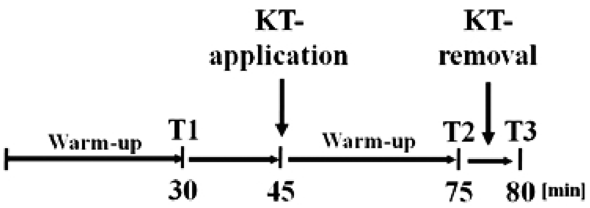

Figure 3 — Schematic illustration of the test protocol. Abbreviations: T1–T3, time points of measurement; KT, kinesio tape.

Discussion

The aim of the study was to test the hypothesis that the application of KT enhances jump performance of elite female track and field athletes. We did not observe any performance enhancement of KT application on jump performance of elite female track and field athletes. Specifically, jump performance during the double 1-legged jump test did not improve with KT compared with the test without KT and immediately after removing the KT ($P < .05$). The low effect sizes calculated between TL and C at all time points suggest that even a larger sample size would fail to result in significant differences between the testing conditions. Our results present data for the effects of KT on elite female athletes, a population that has never been examined in this context before.

Although we did not measure any strength parameters of our female athletes, findings from a recent study by Vithoulka et al[10] revealed that the strength of the quadriceps femoris muscle at maximum eccentric isokinetic exercise increased when KT was applied to the skin above the quadriceps muscle in healthy females. The participants in Vithoulka´s study were described as healthy, but no information regarding their activity status was provided, suggesting that they were rather untrained compared with our elite track and field athletes. It is possible that highly trained athletes may respond differently to KT application than novices. In support of this, Fu et al[13] reported no influence of KT on muscle strength in martial arts athletes. The athletes were highly specialized in their discipline. As such, it is unlikely that these highly trained athletes would benefit from varying muscle activation in response to KT application.

The athletes in the current study were highly specialized in track and field disciplines. Moreover, our athletes were squad members usually characterized by a high level of jump performance. Findings from several studies with squad members have shown that their ability to benefit from variations in their conditioning program is limited, since their performance level is already close to their limits for further adaptation.[20] This may help explain the discrepancy of our data compared with those of Vithoulka et al,[10] who included inactive females in their investigation.

In general, the mechanism by which KT application improves athletic performance has not yet been fully elucidated. A recent systematic review by Williams et al[21] examining treatment and prevention methods for sports injuries suggested rather small but beneficial effects for improving strength and muscle activity. On the other hand, improved tactile input of the skin[11] and fascial unloading[8] were discussed as possible mechanisms for increasing strength and jump performance. However, an investigation with elite male athletes confirmed our findings. The absence of performance benefits in elite athletes compared with untrained participants may be due to a distinct recruitment of muscle fibers of the skeletal muscle during maximal exercise. Thus, it is likely more difficult for sensory input of the skin to modulate muscle performance.[17] Furthermore, it is unknown how much time is required for the application of KT to develop its peak effect. There is evidence that strength effects on gastrocnemius muscles can be immediate, while the use of KT for hamstrings increases hamstring peak force with a delay of 2 days.[8]

Findings from the latter studies are difficult to compare with those of the current study as there are at least 4 types of KT to choose from and variations in the taping techniques. Almost all investigators refer to Kenzo Kase, the inventor of the original material, and his application technique.[18] Kase et al[18] give precise explanations on how to apply KT to achieve desired effects. However, the methods describing KT application in many studies is variable. In this regard, studies aiming to improve strength abilities when applying KT from proximal to distal, as suggested by Kase, failed to achieve effects.[11,16,17] Of note, a study using a combination of activating and deactivating techniques showed performance improvements for both techniques.[8] Moreover, there are discrepancies concerning the degree of KT tension that is used for its application. Again, most investigators refer to the original technique according to Kase, who suggests a maximum stretching of the muscles and a tape application without tension for activating muscles. However, some investigators applied KT with tension and without distinct stretching of the muscles,[17] some with tension and stretching,[18] and some gave no detailed information.[11,16]

Limitations of the study include the selected athletic population. As the sample included only uninjured elite female track and field athletes, the transfer of the current findings to nonathletic populations, male athletes, and those of other athletic disciplines is limited. Furthermore, this study only investigated the acute effects of KT on jumping performance, and not whether chronic application of KT would function as an ergogenic aid to improve jump performance. Furthermore, there is consensus neither about the effects of KT application nor about the precise application technique and the time that is needed to achieve effects. We are aware that investigating more mechanistic data such as surface electromyography, as well as isometric and dynamic strength, would have provided insight into the mechanisms underlying KT application and performance enhancement. However, the data were collected from some of the best German female athletes at the time. These athletes attended a large number of competitions and spent a significant amount of time traveling and therefore lacked time to fully participate in that type of study.

Conclusion

Previous studies have shown that the use of KT alters ergogenic parameters such as muscle activation and proprioception in athletes. In the current study, KT applied to the muscles involved in jump performance in uninjured female elite athletes had no influence on jumping distance in the double 1-legged jump test. Therefore, we conclude that healthy uninjured elite female athletes competing in jump disciplines will not enhance jumping performance by applying KT.

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