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Original research

A pilot study of the effect of Kinesiology tape on knee proprioception after physical activity in healthy women

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ABSTRACT

Objectives: Kinesiology tape has gained significant popularity in recent years and is widely used as an adjunct for treatment and prevention of musculoskeletal injuries. However, evidence regarding its influence on knee proprioception is scarce. The purpose of this study was to evaluate the effect of Kinesiology tape on knee proprioception after physical activity in healthy women. It was hypothesized that Kinesiology tape enhances knee proprioception.
Design: Longitudinal analysis, pretest–posttest design.
Methods: Twelve young women with healthy knees were tested for knee proprioception without the use of Kinesiology tape and wearing Kinesiology tape at the knee. The joint position sense was measured at the start and after a 30-min uphill walking protocol on a treadmill. Outcome was the knee angle deviation.
Results: No significant difference of proprioceptive performance between the application with Kinesiology tape and without Kinesiology tape was found after uphill walking ($p > 0.05$). However, when the participants' results for knee angle deviation were graded into good (<6.1°) and poor (>6.1°), Kinesiology tape significantly enhanced those with poor proprioceptive ability after uphill walking, compared to the untaped knee ($p = 0.002$).
Conclusions: This study has shown that the application of Kinesiology tape did not improve knee proprioception in a group of healthy young women. However, it also has demonstrated that Kinesiology tape provided significant proprioceptive enhancement at the knee joint after uphill walking in healthy women with poor proprioceptive ability. This may support its use in sports medicine for preventing knee injuries.

1. Introduction

Knee injuries account for up to 60% of all sport injuries and belong to one of the most common injury trauma images in sport.[1,2] Based on the athlete's long history of suffering from a knee injury and its negative impact such as chronic joint instability, altered muscle reflexes, increased risk of recurrent injuries, degenerative changes and limitation of performance, there exists a great interest with regard to preventive measures.[3,4] In recent years, the use of a new therapeutic tool called Kinesiology tape (KT) has become increasingly popular within the sporting area for prevention of sports-related injuries. KT, developed by Dr. Kenzo Kase in the 1970s, is a thin, air permeable, water resistant and elastic adhesive tape. Due to its elastic features, KT can be stretched to 120–140% of its resting length and then subsequently recoil back to its original length following application.[5] Providing constant shear force to the skin, KT is designed to mimic the qualities of human skin through its specific thickness and high elasticity. Compared with conventional tapes, KT allows a partial to full range of motion for the applied joints, leading to less restriction of movement and can be worn for 3–4 consecutive days without the need for reapplication.[5,6]

One of the proposed benefits of KT is enhancement of proprioception,[5] defined as the outcome of the central processing by the central nervous system of afferent information from various mechanoreceptors about joint position, joint movement and joint force.[7] The additional cutaneous stimulation provided by the compressive and stretching effect of KT conveys more information regarding joint position and movement to the central nervous system for integration resulting in enhanced proprioception.[8,9] Some studies determined an improved proprioception through

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augmented cutaneous sensory feedback supplied from the KT.[10–12] In contrast, several studies have shown a significant diminishment in knee joint position sense after fatigue exercises, like cycling and running.[13–15] This deterioration in proprioception may lead to an increased risk of knee injury. A correlation between the occurrence of knee injuries and a deficit of proprioception via physical fatigue was already described by Zazulak et al. (2007).[16] Even though proprioception plays an essential role in the prevention of acute injuries,[17] only a few studies have examined the effect of KT on proprioception at the lower extremities. Murray and Husk (2001) as well as Elshemy et al. (2013) demonstrated an improvement in proprioception at the ankle with the application of KT in persons with ankle instability,[10,11] whereas Halseth et al. (2004) found no change in ankle proprioception with KT in uninjured persons.[18] Concerning the proprioceptive effects of KT on knee joints, Aytar et al. (2011) showed no enhancement in proprioception using KT in women with patellofemoral pain syndrome.[19] However, to date there is a lack of research exploring the effect of KT on knee proprioception in healthy persons with the additional influence of physical fatigue. A positive influence of KT on knee proprioception after physical activity would be beneficial for healthy athletes regarding injury prevention. In addition, previous studies have found that persons who have a poor proprioceptive ability showed an improvement after application of an external device, such as tape or bandage.[20–22] Therefore, healthy persons with poor proprioception in particular might benefit from the application of KT.

The purpose of the present study was to investigate the effect of the application of KT on knee proprioception after physical activity in a group of young healthy women. It was hypothesized that KT applied to the anterior thigh and knee enhances knee proprioception compared to the use without KT. Furthermore, it was hypothesized that especially women with poor proprioceptive status benefit from the application of KT after physical activity.

2. Methods

Twelve healthy female sport students of the University of Innsbruck (age: 23.6 ± 2 years, height: 168.7 ± 5 cm, weight: 57.8 ± 4.4 kg, mean ± SD) took part in this study on a voluntary basis. The participants were non-professional sportswomen and had no history of major and minor hip, knee or ankle injuries or pathology or neurological diseases. Of the twelve women asked, no women were excluded and the data from all women was included in the final analysis. All participants provided written informed consent, and the study was approved by the Institutional Review Board and the Ethical Commission of the University of Innsbruck.

The measurements took place in the climatic chamber (Kältepol, Austria) of the Centre of Technology of Ski and Alpine Sports at the Department of Sport Science (Innsbruck, Austria). The room temperature was 23 °C at a relative humidity of 50%. The participants had to wear sports shorts, short socks and sports shoes. Each participant performed the test twice, separated by a week: once without the use of KT (**untaped**) and once with the application of KT (**Kinesiology tape**) at the knee joint at the dominant leg, in a randomized order. The dominant leg was determined as the leg used to kick a ball (right side in all the participants). KT was applied at the beginning of the measurement and the participant wore the tape for the entire duration of the test. The exercise protocol, performed on a treadmill (pulsar, h/p/cosmos, Germany), consisted of a 30-min uphill walking at a speed of 3 km/h and an inclination of 20%.

Knee joint position sense, an indirect measure of proprioception,[7,23] was evaluated prior to uphill walking (start) and immediately after uphill walking (after uphill). The technique of the active angle reproduction test in an open kinetic chain was used.[13,15,24] In the measurement setup, the participant was seated in a comfortable position, with the legs hanging freely, and blindfolded to remove visual input. From the starting position of 90° of flexion, the dominant leg of the participant was passively extended by the investigator to a randomly selected knee angle (target angle) between 20° and 70°. The participant was instructed to relax completely the examined leg and avoid an active muscle contraction during the placement of knee angle. The target angle was held for 5 s to enable the participant to memorize it, than the investigator returned the leg passively to the starting position. After a pause of 5 s the participant was requested to actively reposition its leg as closely to the target angle as possible (actual angle), to hold the position for 5 s and then move the leg back to the starting position. This process was repeated six times in series. For familiarization a trial run was performed with three repetitions.

Fig. 1. Kinesiology tape at the quadriceps and knee joint on the dominant leg.

The participants were taped with three pink colored KT strips (Nasara Original Kinesiology Tape) at the quadriceps and knee on the dominant leg (Fig. 1) according to the recommendation of Kase (2003).[5] For the KT application the participants were sitting with the knee flexed at 90°. The first KT strip was fixed on the vastus lateralis muscle from 10 cm below the greater trochanter major to the lateral edge of the patella. Subsequently, the tape circled around the patella. For the vastus medialis muscle the second KT strip was applied to the middle third from the medial region of the thigh to the medial edge of the patella. Subsequently, the tape circled around the patella. The first 3 cm of the tapes were not stretched (without stretching tension) and acted as the anchor. The portion between the anchor and superior patella was stretched with approximately 75% of its maximal length tension. The tape around the patella was stretched to 120% (maximal stretching tension). Both ends remained un-stretched and intersected. Finally, a third KT strip with a length of 10 cm was placed over the patella with maximal tension.

Before starting the measurements, three markers were attached to the dominant leg of the participant. One marker was located at the lateral malleolus, the next marker at the lateral femoral epicondyle and the third one 10 cm distal from the greater trochanter. All tests were recorded with a camera (Exilim Pro EX-F1, Casio, Japan). The coordinates of the three markers were extracted from the videos using two-dimensional automatic digitizing software programmed in Labview (LabVIEW 2011, Ver. 11.0.1f2, National Instruments, USA). From these data, the knee flexion angles were determined by custom made software programmed in MatLab