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Does Kinesiology tape counter exercise-related impairments of balance in the elderly?

Simona Hosp[a,*], Robert Csapo[a,b], Dieter Heinrich[b], Michael Hasler[a], Werner Nachbauer[b]

[a] Centre of Technology of Ski and Alpine Sports, Fürstenweg 185, 6020 Innsbruck, Austria
[b] Department of Sport Science, University of Innsbruck, Fürstenweg 185, 6020 Innsbruck, Austria

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ABSTRACT

Background: Maintaining balance is an essential requirement for the performance of daily tasks and sporting activities, particularly in older adults to prevent falls and associated injuries. Kinesiology tape has gained great popularity in sports and is frequently used as a tool for performance enhancement. However, there is little research investigating its influence on balance.

Research question: The purpose of this study was to evaluate the effect of Kinesiology tape on dynamic balance, postural stability and knee proprioception after physical activity in healthy, older adults.

Methods: Twelve physically active, healthy men aged 63–77 years performed the test on two separate days, with and without Kinesiology tape at the knee joint (prospective intervention with cross-over design). Dynamic balance during an obstacle-crossing task, postural stability in a single-leg stance test, and knee joint position sense as a measure of proprioception were examined before and after 30 min of downhill walking on a treadmill. The influences of taping condition and physical activity on all parameters were statistically tested using factorial ANOVAs.

Results: Factorial ANOVA revealed significant time × taping condition interaction effects on all performance parameters ($p < 0.05$), indicating that the exercise-related changes in dynamic balance, postural stability and knee proprioception differed between the two taping conditions. The deterioration of performance was always greater when no tape was used.

Significance: This study demonstrated that physical exercise significantly deteriorated dynamic balance, postural stability and knee proprioception in older men. These effects can be attenuated through the usage of Kinesiology tape. By preventing exercise-related impairments of balance, Kinesiology tape might help reduce the risk of sports-associated falls and associated injuries.

1. Introduction

The maintenance of balance is an essential requirement for motor skills of daily living as well as functional activities in sport [1,2]. Impairments in balance provoked by the aging process [3,4] are acknowledged as a major predictor of falls [3,5,6], which are a leading cause of injuries in older adults, and thus, represent a significant socioeconomic burden [7]. Fall prevention strategies frequently rely on the use of assistive devices, treatment of medical conditions, reduction in the use of balance-impairing medication, or elimination of home hazards [8]. However, in community-dwelling older adults about 50% of falls occur during physical activity outdoors, and affect mainly healthy and physically active people [9]. Indeed, many falls reportedly appear during walking, a popular leisure-time activity in seniors [10]. Here, fall risk may be exacerbated by physical fatigue which has been shown to negatively influence balance [11–13]. While appropriate physical preparation may be most effective [14], auxiliary tools to counter physical fatigue and the associated deterioration of balance during prolonged physical activity continue to attract the attention of athletes, practitioners and the scientific community [15].

One such tool is Kinesiology tape (KT) which has gained increased popularity in recent years, and is widely used within the sports community to improve functional performance and prevent musculoskeletal injury [16]. KT is a thin, air permeable, water resistant and elastic adhesive tape which can be stretched to up to 120–140% of its resting length [17]. The protective effect provided by KT is purportedly related to its ability to improve proprioception by stimulating mechanoreceptors located in muscle, tendon, joint capsule or skin [17–21].

* Corresponding author.
E-mail addresses: Simona.Hosp@uibk.ac.at (S. Hosp), Robert.Csapo@uibk.ac.at (R. Csapo), Dieter.Heinrich@uibk.ac.at (D. Heinrich), Michael.Hasler@uibk.ac.at (M. Hasler), Werner.Nachbauer@uibk.ac.at (W. Nachbauer).

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Such enhancements could indirectly lower fall risk since proprioception has been found to be an important determinant of balance [22,23]. Yet, previous studies testing the influence of KT on proprioception [24–26] and balance [27–29] in young, healthy individuals have revealed inconsistent results, with the preponderance suggesting that neither of the two measures may be positively affected by KT application. However, previous research also indicates that the effectiveness of KT with respect to its capacity to influence knee proprioception and balance may differ between subjects [15,25]: Reportedly, individuals whose initial balance is poor benefit more from the application of KT [15]. Since postural control decreases with advancing age [3,4] and in the fatigued state [11–13], it can be expected that potential balance-enhancing effects of KT would most likely be evident in older cohorts after physical exertion.

The purpose of the present study was to investigate the effect of KT on dynamic balance, postural stability and knee proprioception after physical activity in a group of elderly, healthy men. It was hypothesized that KT applied to the anterior aspect of thigh and knee would attenuate or even prevent the exercise-related deterioration of dynamic balance, postural stability and knee proprioception observed when no tape was used.

2. Methods

2.1. Participants

Twelve healthy, physically active older men aged between 63 and 77 years took part in this study on a voluntary basis (age: 68.3 ± 4.5 years, height: 178.5 ± 5.1 cm, weight: 80.3 ± 9.8 kg, mean ± SD, no dropouts). Participants were free of hip, knee, or ankle injury or pathology as well as neurological disease. Participants gave written informed consent to the study that was approved by the Institutional Review Board of the University of Innsbruck. The measurements were carried out in the biomechanics laboratory at the Department of Sport Science of the University of Innsbruck (Austria). Participants performed the test on two days in a randomized order, separated by one week: once without the use of KT (No tape, NT) and once after the application of KT at the knee joint of the dominant leg. For randomization, participants were requested to draw a lot to determine the order of the test conditions (seven participants were tested with KT first). The dominant leg was defined as the leg preferentially used to kick a ball (right side in all participants) [29–31]. In KT sessions, KT was applied at the beginning of the measurement and worn by the participants for the entire duration of the test.

2.2. Procedures

Physical stress was imposed through a 30-min downhill walk on a treadmill (pulsar, h/p/cosmos, Germany) at an inclination of 20% [14,30]. A “natural” walking speed, contingent upon the participants' leg length, was calculated using the equation $v = \sqrt{2g} \cdot \pi^{-1} \cdot \sqrt{l}$, where l represents the length of the leg (m) and g is the gravitational constant (9.81 m/s^2) [32]. Dynamic balance, postural stability and knee proprioception were evaluated prior to and immediately after downhill walking. Before starting the measurements, the participants warmed-up for five minutes on a cycle ergometer (80 W, 60 rpm). The test protocol reflecting the order of measurements is shown in Fig. 1.

To assess dynamic balance, kinetic and kinematic data were

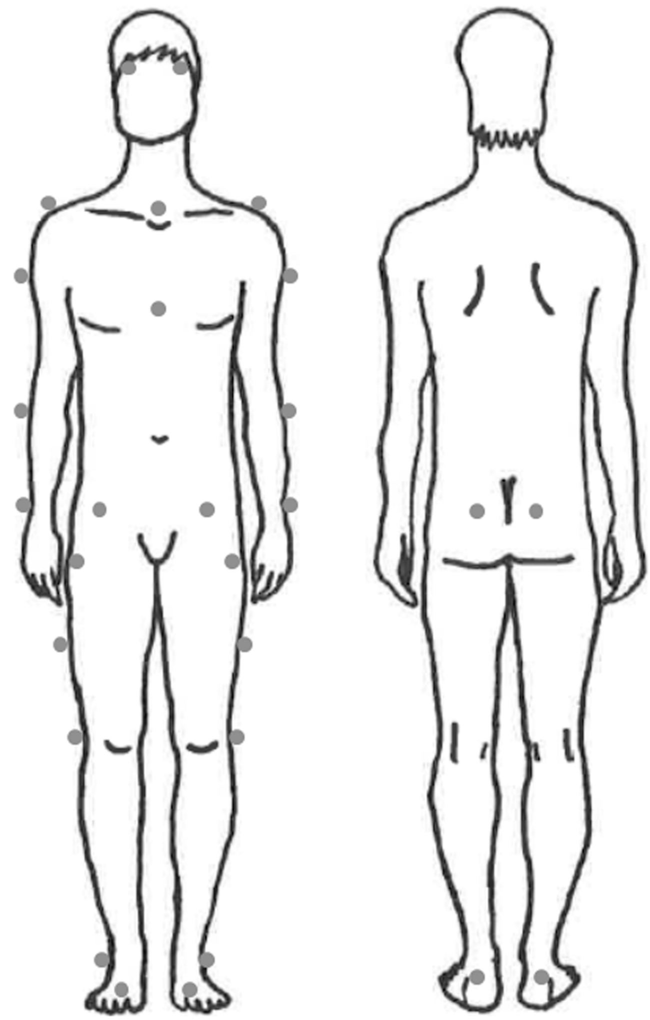

Fig. 2. Position of the 28 reflective markers placed on bony landmarks of the participant to calculate the body center of mass (COM).

acquired during an obstacle-crossing task [33,34]. Participants were instructed to walk along a 2-m walkway, step over an obstacle with the dominant leg, and continue walking along the walkway, at a comfortable self-selected pace. The obstacle was centered between two force plates and consisted of two adjustable upright stands and a padded crossbar, which was positioned at a height corresponding to 60% of the individual leg length (approximately knee height). The crossbar was made of a plastic pipe with a length of 1.5 m and a diameter of 2.5 cm. Participants completed two practice trials before performing three consecutive test repetitions [34]. Whole-body motion data were collected using an eight-camera motion analysis system (Vicon, Oxford Metrics, UK) with a set of 28 reflective markers positioned as recommended by Han and Chou [34] (Fig. 2). Two additional markers were placed on each end of the obstacle to identify its location. Three-dimensional marker trajectory data were collected at a sampling rate of 125 Hz and low-pass filtered using a fourth-order Butterworth filter with a cutoff frequency of 8 Hz. The body center of mass (COM) position was calculated using freely available simulation software

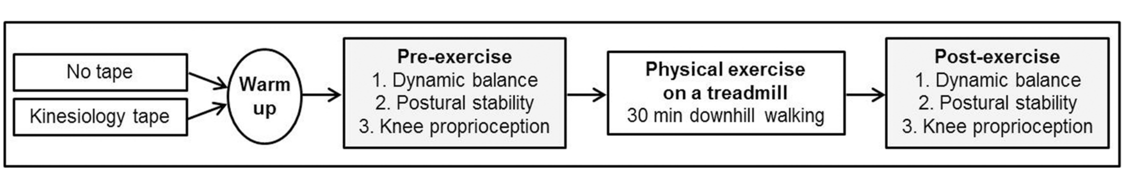

Fig. 1. Test protocol with the individual measurements.

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