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ORIGINAL RESEARCH

Effect of Kinesiology Tape on Measurements of Balance in Subjects With Chronic Ankle Instability: A Randomized Controlled Trial

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Abstract

Objective: To examine the immediate and prolonged effects (7d) of Kinesiology Tape (KT) on balance in subjects with chronic ankle instability using computerized dynamic posturography (CDP).

Design: A 7-day follow-up, single-blind randomized controlled trial.

Setting: University community.

Participants: Subjects (N=36) were screened for possible eligibility criteria, and 30 successfully completed the study protocol. Of these, 15 were randomly assigned to the experimental group (KT: 5 men, 10 women), and 15 were assigned to the control group (placebo tape: 10 men, 5 women).

Interventions: The experimental group was taped for a lateral ankle sprain with KT. In the control group, a placebo tape was used. Balance was assessed under the following 3 conditions: without taping, immediately after application, and after 7 days of use.

Main Outcome Measures: The CDP device used in this study was the Smart Equitest version 8.2. CDP analysis was conducted using the Sensory Organization Test (SOT). As primaries outcome measures, the composite SOT score and composite SOT strategy were chosen. The partial score for SOT condition 2 and its strategy were considered as the secondary outcomes measures.

Results: Repeated-measures analysis of variance (ANOVA) demonstrated that there was not a significant interaction between group and time in the composite SOT score ($F=.239$; $P=.73$), SOT condition 2 ($F=.333$; $P=.705$), and SOT strategy 2 ($F=.899$; $P=.43$). Additionally, repeated-measures ANOVA showed a significant effect for time (composite SOT score: $F=40.69$; $P\leq.01$; SOT condition 2: $F=4.61$; $P=.014$; SOT strategy 2: $F=.899$; $P=.413$; composite SOT strategy: $F=15.14$; $P\leq.01$). Specifically, post hoc analysis showed that both groups obtained improvements in composite SOT scores immediately after tape application and 7 days of use.

Conclusions: According to our results, the SOT scores of both the KT and control groups improved during follow-up. No differences between them were observed during the follow-up in most balance measurements. The observed changes may be related to a subjective increase in confidence after the tape application.

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Ankle sprains have the highest incidence rate of lower-limb injuries, affecting 206 of 100,000 persons per year.[1] Most ankle ligament injuries are caused by sudden flexion and inversion of the ankle joint, which impairs the lateral ligamentous structure.

Chronic ankle instability (CAI) is a significant orthopedic concern in physically active individuals and characterized by a recurrent perception of the ankle giving away.[2] Up to 32% of people will develop CAI after ankle sprain. Of these affected individuals, 72% will have their function impaired,[3] producing changes in sporting and occupational activities, impinging on the patient's quality of life. Additionally, people with CAI

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demonstrate a higher risk of developing posttraumatic ankle osteoarthritis.[2]

CAI includes, independently or in combination, mechanical instability, recurrent sprain (34%),[4] and perceived instability known as functional ankle instability (FAI). It is believed that FAI is caused by muscle weakness and lack of proprioceptive sense with loss of neuromuscular control, which lead to reduced balancing ability and proprioception.[1,5] Patient questionnaires are used for making the diagnosis of CAI. These provide reliable measurement of patient-reported symptoms (eg, pain, functional limitations, instability occurrence) with specific activities.

The reduction in proprioception of patients with CAI is known to be caused by blockage of afferent nerve fibers of mechanoreceptors located on the articular capsule and ligament of the ankle (deafferentation of the lateral ankle ligaments) caused by chronic injury or instability of the ankle.[5] Therefore, impairments in both static and dynamic balance have been shown to be present in individuals with CAI.[6] Specifically, individuals with CAI increase displacement in the body's center of pressure, showing a greater mediolateral and anteroposterior center of pressure velocity than healthy subjects.[6-8]

The use of elastic tape, Kinesiology Tape (KT), in sports medicine practice has recently gained popularity. It is manufactured with a special weave and viscosity that allows ventilation and water resistance, with more expanded elasticity and a minimization of skin discomfort.[9-11] KT is reported to elevate the skin, thereby allowing improved blood flow and drainage of lymphatic fluid.[8-11] This process is stated to facilitate pain relief and support injured muscles and joints for a more rapid recovery. Despite its popularity, there is limited evidence in the medical literature to support the efficacy of kinesiology taping.[8] KT is used to treat several disorders, such as carpal tunnel syndrome (median entrapment neuropathy that causes paresthesia, pain, numbness, and other symptoms in the distribution of the median nerve as a result of its compression at the wrist in the carpal tunnel), lower back strain/pain (subluxations, herniated disk), knee conditions (tendinopathies and knee sprains), shoulder conditions (rotator cuff tendonitis, rotator cuff impingement syndrome, and a rotator cuff tear), hamstring and adductor strain or tear, whiplash, tennis elbow (acute or chronic inflammation of the tendons that join the forearm muscles on the outside of the elbow), plantar fasciitis, patella tracking disorders (patella shifts too far toward the outside of the leg caused by weak thigh muscles), pre- and postsurgical edema, ankle sprains, and athletic injury prevention.[9]

The relation between balance, CAI, and KT has been an interesting research area in recent years.[11-16] According to KT studies, there is discrepancy among the results. This inconsistency may be attributed to how the trials were conducted. On the one hand, KT may have different applications to treat the same injury: tendon and/or ligament correction, muscle technique, or a combination of techniques. On the other hand, trials are limited in terms of quantity and methodologic quality. Previous studies applied different tests of evaluation, some of them subjective. In this sense, newer techniques, such as computerized dynamic posturography (CDP), have facilitated objective evaluation of subjects with balance disorders. The use of CDP not only allows quantification of the subject's capacity to maintain a stable center of gravity (COG), but it also provides analysis of the degree to which the subject is able to use different types of sensory information (ie, visual, vestibular, proprioceptive) through the Sensory Organization Test (SOT), which is considered the criterion standard of posturography.[17] CDP has been shown to be a cost-effective and useful technique for the characterization and monitoring of patients with balance disorders.[18,19]

According to several systematic reviews, conclusive recommendations for practice cannot be made.[20-23] Montalvo et al,[23] in a recent systematic review published in 2014, concluded that KT may have a subjective effect on pain perception in different musculoskeletal disorders. According to this review, further research that uses controlled measures compared with KT is needed to evaluate efficacy. Under these circumstances, the purpose of this study was to examine the immediate and prolonged effects (7d) of KT on balance in subjects with CAI using CDP.

List of abbreviations:

ANOVA	**analysis of variance**
CAI	**chronic ankle instability**
CAIT	**Cumberland Ankle Instability Tool**
CDP	**computerized dynamic posturography**
COG	**center of gravity**
FAI	**functional ankle instability**
KT	**Kinesiology Tape**
SOT	**Sensory Organization Test**

Methods

Participants

Subject recruitment was undertaken by placing ads on school notice boards. The study sample consisted of 36 university volunteers between the ages of 18 and 28 years old. Candidates were interviewed by a member of the research team regarding their ankle joint injury history, and all interested individuals were also required to complete the Cumberland Ankle Instability Tool (CAIT) for both ankle joints. The CAIT is a simple tool which has high reliability and validity in differentiating people with healthy ankles from those with FAI.[24,25] It consists of 9 questions relating to ankle stability, pain, and recovery from rolling incidents. The score ranges from 0 to 30, with lower scores representing more instability. The recommended cutoff to separate stable ankles from ankles with FAI is $\leq$27.[24]

Of 36 potentially suitable candidates, 30 met the full inclusion criteria. Subjects were included if they presented a history of at least 1 acute lateral ankle sprain that resulted in swelling, pain, and temporary loss of function (but none in the prior 3mo); history of multiple episodes of the ankle giving way in the last 6 months; a score $<$27 on the CAIT; and evidence of mechanical instability assessed by a physician using an anterior drawer test (an anterior drawer difference of 10mm compared with the contralateral ankle). Subjects were excluded if they reported history of lower-limb injury other than the unilateral CAI and/or skin allergy to the tape.

Before testing, the subjects were not actively involved in any kind of physical activity, were pain free, and were not involved in any rehabilitation program. All participants were able to perform full weight bearing on both legs at the time of assessment. No requirements existed for specific sport activity levels among participants.

Ethical aspects

All participants provided written informed consent before participation in this investigation, which was approved by the ethics