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Title: Comparison of the Effects of Kinesiotaping and Dynamic Taping on Electromyographic Activity of Selected Muscles in Female Athletes with Chronic Ankle Instability

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Abstract

Background: Chronic ankle instability (CAI) is associated with altered muscle activation patterns. Taping, as a supportive intervention, may influence muscle activity and joint stability. The present study aimed to compare the effects of Kinesiotaping (KT) and Dynamic taping (DT) on the electromyographic (EMG) activity of selected muscles in female athletes with CAI.

Methods: In this repeated-measures crossover study, 21 female athletes with CAI participated. EMG activity of eight selected lower-extremity muscles was assessed across three separate sessions under three conditions: KT, DT, and no taping. Participants performed a single-leg drop vertical jump task, and EMG data were collected during the feedforward, deceleration, and acceleration phases, as identified by video-based kinematic analysis. Data were analyzed using repeated-measures analysis of variance at a significance level of $p \leq 0.05$.

Results: The findings demonstrated that, during both the feedforward and deceleration phases, DT significantly reduced the activity of the tibialis anterior and peroneus longus muscles compared with the no-taping condition ($p < 0.05$). The reduction in tibialis anterior activity during the deceleration phase was also significantly greater than that observed with KT ($p = 0.027$). In addition, medial gastrocnemius activity during the feedforward phase was significantly reduced in both taping conditions compared with the no-taping condition ($p < 0.05$). However, no significant differences in muscle activity were observed during the acceleration phase ($p > 0.05$).

Conclusion: The results suggest that DT modulates distal lower-extremity muscle activation patterns during the preparatory and shock-absorption phases and may serve as a supportive approach to reduce the compensatory activation demands placed on these muscles.

Keywords: Ankle sprain, Taping, Electromyography, Muscle activity, Drop vertical jump

Highlights

- Dynamic taping significantly reduced tibialis anterior and peroneus longus muscle activity during the feedforward and deceleration phases.
- Both taping methods decreased feedforward activity of the medial gastrocnemius muscle, although Dynamic taping demonstrated a greater effect.
- The activity of proximal lower-extremity muscles distant from the taping site did not show any significant change.

Plain language summary

Chronic ankle instability (CAI) represents a prevalent condition in athletic populations that may impair ankle-related neuromuscular function and compromise effective muscle control. Taping is often used as a supportive intervention to improve joint stability and muscle performance. This study examined the effects of two elastic taping methods, Kinesiotaping and Dynamic taping, on lower-leg muscle activity in female athletes with CAI. The findings showed that Dynamic taping reduced the activity of certain muscles and improved ankle motor control. Overall, Dynamic taping may help enhance joint stability and improve functional movement performance in these athletes.

Introduction

Ankle sprains constitute approximately 15–20% of athletic injuries and occur frequently in sports including basketball, soccer, and volleyball (1). The incidence of this injury has been reported to be higher among female athletes and in sports involving sudden changes of direction, landing, and jumping tasks (2). Ankle sprains may occur through contact or non-contact mechanisms, and in many cases, complete recovery is not achieved. A proportion of individuals who sustain an ankle sprain continue to experience symptoms and may eventually develop chronic ankle instability (CAI) (3). CAI is considered a multifactorial condition involving alterations in sensory perception, mechanical function, and motor control. Individuals with CAI commonly report recurrent episodes of the ankle giving way, pain, reduced muscle strength, limited joint mobility, impaired functional performance, and an increased risk of recurrent ankle sprains. Furthermore, mechanical alterations in lower-extremity movement patterns may exacerbate the sensation of instability and impaired joint control (3,4).

Under normal conditions, healthy individuals are able to compensate for sensory disturbances originating from the foot and ankle by reweighting other sensory inputs; however, this compensatory ability is diminished in individuals with CAI (5). Therefore, impairments in movement planning and execution, as well as deficits in sensory-information processing, have been proposed as major mechanisms underlying disability in these individuals (6). Proprioceptive information obtained from peripheral sensory receptors contributes to the control and coordination of human movement. This sensory input is particularly relevant for the foot–ankle complex because this region provides the main interface between the body and the external surface during standing and locomotor activities. Changes in proprioceptive feedback may therefore influence joint position awareness and the regulation of movement patterns. This sensory system contributes to joint positioning and trunk movement coordination (7,8), while damage to mechanoreceptors may impair neuromuscular control (9). As a result, individuals with CAI commonly exhibit proprioceptive deficits, sensorimotor impairments, and biomechanical alterations in kinematic profiles, neuromuscular control schemes, and muscle recruitment patterns, alongside the regulation of lower-limb stiffness during landing maneuvers (10–12).

In individuals with CAI, sensorimotor impairments may be accompanied by alterations in motor-control mechanisms (feedback and feedforward control), changes in the sensitivity of muscle spindles surrounding the ankle, and disturbances in alpha motor neuron activity, ultimately leading to temporal and spatial changes in muscle activation patterns. In this regard, pre-activation of muscles prior to foot–ground contact (feedforward activity) is of particular importance, as it plays a key role in preparing the lower extremity for force absorption during landing and regulating limb stiffness. Evidence regarding muscle activation patterns indicates increased activity of the peroneus longus and tibialis anterior muscles prior to ground contact, changes that are associated with increased ankle eversion motion (4,13). Furthermore, studies have documented altered muscle recruitment patterns during gait, specifically characterized by reduced tibialis anterior engagement and heightened activation of the medial gastrocnemius. Appropriate activation of the peroneal muscles is essential for counteracting potentially injurious forces, particularly during the landing phase. Nevertheless, neuromuscular responses in individuals with CAI have been reported inconsistently (14).

Among therapeutic interventions, rehabilitation exercises, taping, and bracing are commonly used to reduce recurrent sprains and improve function in individuals with CAI (1). Taping, as a passive, low-cost, and accessible intervention, generally causes minimal disruption to daily activities and is thought to improve proprioceptive accuracy, neuromuscular control, and functional stability by restricting excessive motion and enhancing stimulation of cutaneous mechanoreceptors (15). Kinesiotaping (KT), introduced in the 1970s as the first generation of elastic taping, is composed of cotton with acrylic adhesive and can stretch up to approximately 140% of its resting length (16,17). Although KT does not directly restrict joint range of motion, it may enhance postural awareness and reduce instability through stimulation of cutaneous receptors (18).

The use of KT has increased in sports injury management and in individuals with chronic ankle instability (CAI). Nevertheless, existing studies have provided inconsistent findings, and the therapeutic effects of KT have not been clearly established. Although manufacturers claim that KT can facilitate muscle activation and improve motor control, research findings have been inconsistent (16,19,20). Some studies have reported reduced frontal-plane sway and alterations in the activity of muscles such as the PL. Reductions in gluteus medius electromyographic (EMG) activity during single-leg squat tasks and shorter gastrocnemius activation duration during walking have also been observed. In contrast, other studies have found no significant effects on muscle activation patterns (21,22).

Dynamic Tape (DT), in contrast, is a newer generation of elastic taping developed in 2009. Constructed from nylon and Lycra with viscoelastic properties, this tape possesses four-way stretch capability, can elongate beyond 200% of its resting length, and lacks a rigid end point (17). Therefore, in addition to sensory effects, it has the capacity to absorb, store, and release mechanical energy (23). Given the differences between KT and DT in terms of material composition, elastic characteristics, and mechanical properties, it is reasonable to expect that their therapeutic and functional effects may not be identical and may elicit different responses under clinical and sports-related conditions (18,23). However, although elastic taping may improve certain muscular patterns, existing findings remain inconsistent and difficult to generalize due to differences in tape type and the muscles investigated (24–26).

Considering the importance of EMG assessment in individuals with CAI, as well as the presence of abnormal pre-activation patterns in the peroneal, tibialis anterior, and calf muscles, determining which type of tape may guide these patterns toward more efficient function is of particular relevance. Nevertheless, most previous studies have focused primarily on kinematic and biomechanical changes, whereas neuromuscular responses and muscle activation patterns have received comparatively less attention. Moreover, most investigations have evaluated each taping method separately, and direct comparisons between the effects of KT and DT on EMG activity of key muscles, particularly in female athletes with CAI, remain limited. To date, no study has directly compared the effects of KT and DT on EMG activity of lower-extremity muscles during a drop vertical jump task in female athletes with CAI. Therefore, the purpose of the present study was to investigate and compare the effects of DT and KT on EMG activity of selected muscles in female athletes with CAI.

Material and Methods

Study Design

A within-subject crossover study employing repeated assessments was carried out with the participation of 21 female athletes diagnosed with chronic ankle instability (CAI). Before the initiation of the study, the required sample size was determined using G*Power software (version 3.1) based on a repeated-measures analysis of variance model with a within-factor approach. The estimation incorporated an anticipated effect size of Cohen's $f = 0.30$, an alpha level of 0.05, and a statistical power of 0.80 ($1-\beta$). The analysis was performed considering a single experimental group, three repeated testing conditions, and an assumed correlation coefficient of 0.50 between repeated measurements. The calculated minimum sample size was 20 participants. Consequently, 21 female athletes with CAI were included to reduce the impact of possible missing data or participant attrition.

Eligibility criteria were defined according to the recommendations of the International Ankle Consortium (27). Participants were included if they reported a history of at least two ankle sprains on the affected side. The first sprain had to occur at least 12 months before enrollment, while the most recent injury was required to have occurred at least 3 months before the assessment. Participants also needed to demonstrate CAIT scores ≤24 (mean score: 19.14 ± 2.16/30). Individuals were excluded if they received any ankle-related rehabilitation or treatment during the study or had undergone ankle surgery or experienced a fracture within the previous six months. Exclusion criteria included the occurrence of fracture, dislocation, or acute ankle injury requiring immediate medical treatment; the presence of skin disorders or severe hypersensitivity to taping materials; severe ankle instability requiring advanced therapeutic interventions such as physiotherapy or surgery; and participation in strenuous physical activities or exercises outside the study protocol that could influence ankle status.

Before initiating the experimental procedures, all participants were provided with detailed information regarding the aims, methodology, and requirements of the study. After receiving adequate clarification about the research process, each participant voluntarily agreed to participate and completed a written informed consent form. Following consent, anthropometric data including age, height, weight, and other relevant information were collected and verified by the examiner. Each participant attended the laboratory on three separate occasions, with a 48-hour interval between sessions to serve as a washout period and minimize potential residual sensory or mechanical effects of the taping interventions (28). To reduce the possibility of sequence-related bias and familiarity effects, the order in which the three experimental conditions (DT, KT, and no tape) were performed was determined through a randomized allocation process with concealed assignment. Specifically, the three experimental conditions were placed on separate identical cards and subsequently enclosed in sealed, non-transparent envelopes. At the beginning of each session, participants selected one envelope without knowledge of its contents, and the selected envelope determined the condition for that session. Although the visual differences between taping conditions were apparent, participants were not informed about the materials, mechanisms, or expected effects of the interventions. Furthermore, EMG data were coded prior to analysis and provided to the analyst in a blinded manner to minimize potential bias. Thirty minutes after tape application, participants completed a 5-minute general warm-up on a treadmill. Subsequently, surface EMG electrodes were placed over the selected muscles. Muscle activity was then recorded and analyzed during the performance of a single-leg drop vertical jump task.

Interventions

Taping Procedure

Initially, skin preparation was performed by thoroughly cleaning and drying the application area prior to taping. The athlete was then seated on the edge of a treatment table of sufficient height to prevent the feet from contacting the ground. The therapist applied the tape to the injured ankle with approximately 30–40% tension. To standardize the intended level of stretch, a tape-marking technique was used to confirm the target elongation during application. All taping procedures were administered by a trained investigator who had practiced the taping protocol before data collection to ensure consistency in tape placement, marking procedures, and the level of stretch applied.

The taping technique designed by Ryan Kendrick was used in the present study (Figure 1) (29). This method was developed for ankle instability and injuries of the lateral ankle ligaments. According to this technique, the tension applied to the tape in different ankle positions may preferentially protect specific ligamentous structures. When tension is applied in plantarflexion and eversion positions, maximal protection is provided to the anterior talofibular ligament (ATFL). Conversely, when greater tension is applied in dorsiflexion and inversion positions, the posterior talofibular ligament (PTFL) receives greater protection.

Figure 1. Taping procedure from the left and right lateral views (a = Dynamic Tape; b = Kinesiotaping)

EMG

Surface EMG recordings were obtained after appropriate skin preparation. If required, hair was removed from the measurement area, and the skin was cleaned using alcohol to minimize impedance and improve signal quality. Electrode locations were identified based on SENIAM recommendations. Following anatomical identification of each muscle, bipolar electrodes were positioned along the muscle fiber direction while maintaining a consistent inter-electrode distance. The assessed muscles included the tibialis anterior, peroneus longus, medial and lateral gastrocnemius, vastus medialis, vastus lateralis, gluteus medius, and semitendinosus. Electrode placement was performed according to SENIAM guidelines (30): tibialis anterior (one-third of the distance between the fibular head and medial malleolus), peroneus longus (25% of the distance between the fibular head and lateral malleolus), medial gastrocnemius (at the area of greatest muscle prominence), lateral gastrocnemius (one-third of the line between the fibular head and heel), vastus medialis (80% of the line between the anterior superior iliac spine and medial knee joint space), vastus lateralis (two-thirds of the line between the anterior superior iliac spine and lateral patellar border), gluteus medius (midpoint between the iliac crest and greater trochanter), and semitendinosus (midpoint between the ischial tuberosity and medial tibial epicondyle). After electrode placement, participants completed a single-leg drop vertical jump task (SLDVJ), landing on one leg after stepping from a 30-cm box and immediately performing a vertical jump (Figure 2). Three trials were performed for each participant, with a 30-second interval between trials to limit fatigue-related effects. EMG signals were collected and stored during task execution.

Measurement reliability was evaluated using ICC values, which ranged from 0.59 to 0.87 (mean ICC = 0.74), indicating moderate to good consistency.

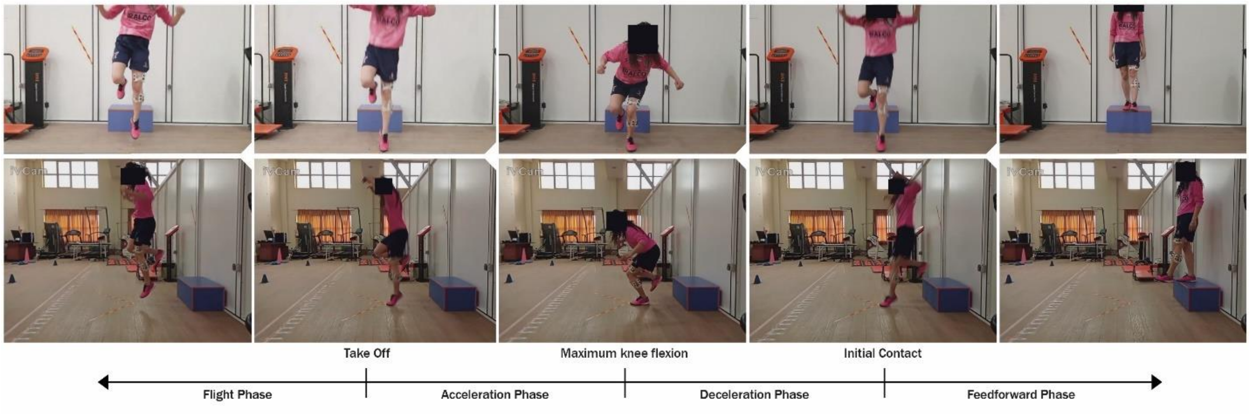

Figure 2. Phases of the single-leg drop vertical jump task. (feedforward: 100 ms before initial contact; deceleration: initial contact to maximum knee flexion; acceleration: maximum knee flexion to take-off)

EMG Signal Processing and Analysis

EMG data processing was conducted using MR4.0.58 software (Noraxon, USA). Electromyographic signals were collected at a sampling frequency of 2000 Hz. During preprocessing, a fourth-order Butterworth high-pass filter with a cutoff frequency of 20 Hz was applied to minimize low-frequency noise and baseline drift. The signals were then processed using a band-pass filter (10–500 Hz) to reduce high-frequency noise. Following filtering, the EMG signals were full-wave rectified, and RMS values were calculated using a 100-ms moving window for signal smoothing. Finally, muscle activity amplitudes were normalized to maximum voluntary contraction (MVC) and reported as a percentage of MVC (%MVC). Normalization was performed using a task-specific MVC approach with the MVC Stack function in Noraxon MR4. By selecting the “Make MVC” option, the software automatically identified the highest EMG activity recorded for each muscle during the SLDVJ trials and used this value as the MVC reference for normalization. Following signal processing and normalization, muscle activity was extracted and analyzed during three phases of the SLDVJ task: the feedforward phase (100 ms prior to initial foot–ground contact), the deceleration phase (from initial foot contact to maximum knee flexion), and the acceleration phase (from maximum knee flexion to take-off).

Statistical Analysis

All statistical procedures were conducted using SPSS software (version 27), with the threshold for statistical significance established at $p < 0.05$. The distribution of the data was examined through the Shapiro–Wilk test to verify the assumption of normality. In addition, Mauchly’s test was applied to evaluate the sphericity assumption, and the Greenhouse–Geisser adjustment was used whenever this assumption was not satisfied. A repeated-measures ANOVA was performed to determine whether the different taping conditions produced significant changes in the outcome variables. In cases where a significant main effect was detected, pairwise comparisons were subsequently carried out using Bonferroni-corrected post hoc analyses ($p < 0.05$).

Results

All 21 participants completed the three experimental conditions, and no missing data were observed. Demographic characteristics, including age, body weight, height, and body mass index of the athletes with CAI, are presented in Table 1.

Table 1. Demographic characteristics of the participants (n=21)

	Age (years)	Weight (kg)	Height (cm)	Body Mass Index (kg/m^2)
Mean ± SD	21.00 ± 2.57	58.38 ± 10.50	165.71 ± 6.25	21.22 ± 3.35
Min–Max	18-27	47-77	154-180	17.68-26.02

The normality of the data distribution was confirmed using the Shapiro–Wilk test ($p > 0.05$ for all variables). Given the normal distribution of the data, repeated-measures analysis of variance (ANOVA) was used to examine differences in muscle activity across the three taping conditions during the single-leg drop vertical jump task. Prior to the main analyses, Mauchly's test of sphericity was conducted. Violations of sphericity were observed for the vastus lateralis and gluteus medius during the feedforward phase, for the vastus lateralis and semitendinosus during the deceleration phase; Greenhouse–Geisser corrections were therefore applied for these variables. The sphericity assumption was satisfied for all remaining variables ($p > 0.05$). The results of muscle activity during the feedforward, deceleration, and acceleration phases under the three conditions (DT, KT, and no tape) are presented in Table 2.

Table 2. Results of repeated measures ANOVA for muscle activation during the single-leg drop vertical jump task

		Feedforward Phase				Deceleration Phase				Acceleration Phase			
Variable (Muscle)		Mean±SD	F	P	η^2p	Mean±SD	F	P	η^2p	Mean±SD	F	P	η^2p
Tibialis Anterior	DT	17.06 ± 09.73	3.480	0.040*	0.148	60.76 ± 11.32	4.486	0.017*	0.183	47.80 ± 13.60	3.169	0.053	0.137
	KT	22.23 ± 14.37				67.59 ± 12.01				56.85 ± 17.21			
	NT	25.56 ± 11.22				68.62 ± 11.01				51.62 ± 13.38			
Peroneus Longus	DT	22.31 ± 12.32	3.801	0.031*	0.160	59.53 ± 10.02	8.321	<0.001**	0.294	86.47 ± 11.57	0.733	0.487	0.035
	KT	26.57 ± 16.84				57.54 ± 09.93				90.05 ± 11.86			
	NT	34.16 ± 19.27				67.88 ± 12.54				89.08 ± 09.35			
Gastrocnemius Lateralis	DT	32.95 ± 09.73	0.920	0.407	0.044	48.12 ± 10.73	1.758	0.185	0.081	96.23 ± 13.26	0.335	0.717	0.016
	KT	31.75 ± 17.53				42.82 ± 11.80				93.72 ± 13.70			
	NT	38.08 ± 17.77				44.90 ± 10.98				95.08 ± 07.92			
Gastrocnemius Medialis	DT	62.77 ± 32.40	4.754	0.014*	0.192	52.26 ± 12.04	2.858	0.069	0.125	91.09 ± 12.50	1.055	0.358	0.050
	KT	60.21 ± 30.50				46.15 ± 11.99				87.67 ± 13.39			
	NT	80.29 ± 35.27				51.67 ± 13.99				92.16 ± 07.53			
Vastus Lateralis	DT	13.30 ± 07.84	0.503	0.549	0.025	65.44 ± 09.37	0.763	0.445	0.037	82.92 ± 11.59	0.763	0.473	0.037
	KT	15.11 ± 10.79				65.00 ± 11.93				86.17 ± 10.98			
	NT	14.44 ± 07.46				67.86 ± 10.47				81.37 ± 14.95			
Vastus Medialis	DT	14.85 ± 07.91	0.108	0.898	0.005	65.52 ± 14.65	0.182	0.834	0.009	78.82 ± 10.86	2.752	0.076	0.121
	KT	15.71 ± 09.09				65.02 ± 10.71				85.88 ± 10.97			
	NT	15.81 ± 09.07				66.87 ± 10.94				78.07 ± 15.04			
Gluteus Medius	DT	16.35 ± 07.80	0.857	0.404	0.041	49.33 ± 14.58	0.343	0.712	0.017	42.67 ± 19.53	0.712	0.497	0.034
	KT	15.40 ± 07.79				49.58 ± 12.91				40.81 ± 19.82			

	NT	18.57 ± 11.55				51.35 ± 11.71				46.75 ± 19.90			
Semitendinosus	DT	28.02 ± 19.55	0.871	0.426	0.042	59.86 ± 11.78	0.213	0.731	0.011	62.83 ± 16.30	0.249	0.780	0.012
	KT	34.57 ± 24.17				61.17 ± 12.74				62.85 ± 13.78			
	NT	30.21 ± 17.93				62.12 ± 16.55				60.17 ± 17.79			

* Significance at $P<0.05$ level; ** Significance at $P<0.01$ level; DT = Dynamic taping; KT = Kinesio taping; NT = No taping (control condition); η^2p = partial eta-squared. Values under each phase are presented sequentially for DT, KT, and NT, respectively.

As shown in Table 2, during the feedforward phase, significant differences between taping conditions were observed for the tibialis anterior ($F(2, 40) = 3.480$, $p = 0.040$, $\eta^2p = 0.148$), peroneus longus ($F(2, 40) = 3.801$, $p = 0.031$, $\eta^2p = 0.160$), and medial gastrocnemius muscles ($F(2, 40) = 4.754$, $p = 0.014$, $\eta^2p = 0.192$), whereas no significant differences were found for the other muscles ($p > 0.05$). Bonferroni post hoc analysis further demonstrated that tibialis anterior activity in the DT condition was significantly lower than in the no-tape condition (mean difference = −8.497, 95% CI [−15.616, −1.378], $p = 0.016$), while no significant differences were observed between the other conditions. Similarly, peroneus longus activity in the DT condition was significantly lower than in the no-tape condition (mean difference = −11.850, 95% CI [−23.342, −0.357], $p = 0.042$), with no other significant pairwise differences. For the medial gastrocnemius, activity was significantly lower in the DT condition compared with the no-tape condition (mean difference = −17.528, 95% CI [−31.982, −3.073], $p = 0.015$) and significantly lower in the KT condition compared with the no-tape condition (mean difference = −20.086, 95% CI [−39.840, −0.331], $p = 0.045$); no significant difference was observed between DT and KT.

During the deceleration phase, significant differences between taping conditions were also observed for the tibialis anterior ($F(2, 40) = 4.486$, $p = 0.017$, $\eta^2p = 0.183$) and peroneus longus muscles ($F(2, 40) = 8.321$, $p < 0.001$, $\eta^2p = 0.294$), whereas no significant differences were found in the remaining muscles ($p > 0.05$). Bonferroni post hoc analysis revealed that tibialis anterior activity in the DT condition was significantly lower than both the KT (mean difference = −6.822, 95% CI [−12.998, −0.646], $p = 0.027$) and no-tape conditions (mean difference = −7.858, 95% CI [−15.169, −0.546], $p = 0.033$), while no significant difference was observed between the KT and no-tape conditions. For the peroneus longus muscle, activity in both the DT (mean difference = −8.343, 95% CI [−15.838, −0.848], $p = 0.026$) and KT (mean difference = −10.339, 95% CI [−17.663, −3.014], $p = 0.004$) conditions was significantly lower than in the no-tape condition, whereas no significant difference was found between the two taping conditions. During the acceleration phase, no significant differences were observed between the different taping conditions for any of the examined muscles ($p > 0.05$).

Discussion

The aim of the present study was to compare the effects of DT and KT on EMG activity of selected muscles in female athletes with CAI during a single-leg drop vertical jump task. The main findings indicated that taping interventions, particularly DT, led to a significant reduction in the activity of the tibialis anterior, peroneus longus, and medial gastrocnemius muscles during the feedforward and deceleration phases, whereas no substantial effects were observed during the acceleration phase.

The tibialis anterior, as one of the primary ankle dorsiflexors, plays a critical role in controlling ankle position at ground contact and in shock absorption (22). Our findings demonstrated that during the feedforward phase, DT significantly reduced tibialis anterior activity compared with the no-tape condition. In individuals with CAI, compensatory overactivation of the tibialis anterior has been reported as a mechanism to counteract joint instability (31,32). The observed reduction in tibialis anterior activity in the presence of DT may reflect a potential mechanical assistance effect of the tape. This interpretation is consistent with previous reports suggesting that taping may contribute to ankle stability through external support mechanisms (33). A key finding of the present study emerged during the deceleration phase, where DT reduced tibialis anterior activity not only compared with the no-tape condition but also significantly more than KT. This difference may be attributed to the viscoelastic properties and higher elastic resistance of DT (34). It is likely that DT, due to its greater mechanical resistance, modulates eccentric control during landing by assisting in the regulation of controlled dorsiflexion, thereby reducing the demand placed on dorsiflexor muscles (23,34). Importantly, the large effect size observed for tibialis anterior activity during the deceleration phase suggests that the influence of taping condition was substantial. From a clinical perspective, this finding warrants attention, as altered neuromuscular control of the ankle is considered a key characteristic of individuals with CAI. While the current study did not evaluate clinical outcomes directly, the observed effect size indicates the importance of future investigations examining whether these neuromuscular adaptations result in clinically relevant changes in functional performance, fatigue tolerance, or the likelihood of injury occurrence.

Regarding the peroneus longus muscle, a key dynamic stabilizer against ankle inversion (22), the results showed that DT significantly reduced its activity in both the feedforward and deceleration phases compared with the no-tape condition. These findings are consistent with the systematic review and meta-analysis by Biz et al. (2022), which synthesized evidence indicating that elastic taping generally decreases peroneus longus activation in athletes with CAI (19). Furthermore, our results align with primary electromyographic and taping studies such as Farzami et al. (2022), Sarvestan et al. (2020), and Fayson et al. (2015), who all reported significant reductions in peroneus longus activity during functional tasks (22,33,35). Previous studies have suggested that elastic taping may reduce the load imposed on evertor muscles by providing lateral mechanical support to the ankle (33). The mechanical assistance provided by taping may alter cutaneous sensory input, leading to a reduced central nervous system requirement for peroneus longus activation to maintain joint stability(36).

During the feedforward phase, both DT and KT resulted in a significant reduction in medial gastrocnemius activity. Previous studies have indicated that individuals with CAI may experience delayed recruitment and reduced force-generating capacity of this muscle during balance and landing activities (22). The observed reduction in EMG activity in the presence of taping may reflect a redistribution of neuromuscular demand due to externally provided joint stability. By limiting postural sway and enhancing passive stability, taping may reduce the requirement for medial gastrocnemius activation during the pre-landing phase. This finding is in line with Yin et al. (2021), who reported that external support strategies can reduce calf muscle loading during functional movements (37).

The results also demonstrated that no significant differences were observed in proximal muscle activity across the different taping conditions. These findings are consistent with Farzami et al. (2022), who reported no significant changes in the feedforward activity of the selected proximal muscles following taping during a single-leg jump-landing task (22). The alignment between these findings suggests that proximal muscle activation during landing may have limited sensitivity to localized interventions applied to the ankle region. One potential explanation is that the effects of taping are primarily localized, predominantly influencing the ankle joint and its surrounding musculature. Taping may alter afferent sensory input by stimulating cutaneous mechanoreceptors and enhancing proprioceptive feedback around the ankle, thereby influencing the activation patterns of muscles acting directly on the ankle joint (38,39). However, these peripheral sensory modifications may not be sufficient to produce meaningful changes in the activation patterns of more proximal muscles involved in landing tasks. It is also possible that the single-leg drop vertical jump task was not sufficiently demanding to elicit detectable compensatory adaptations in proximal muscle activity. Although the task requires coordinated control of the lower extremity to absorb impact forces and maintain postural stability (40), the neuromuscular demands imposed may not have been large enough to reveal subtle proximal adaptations resulting from ankle taping. Consequently, while taping may locally influence muscles surrounding the ankle, its effects may not readily extend to more proximal segments under the conditions examined in the present study. Nevertheless, future research utilizing more complex and challenging tasks, combined with comprehensive kinematic and kinetic assessments, may clarify whether more pronounced adaptations in proximal muscle activity emerge under conditions requiring greater lower-extremity stability.

Additionally, no significant differences were observed during the acceleration phase across any of the investigated muscles. During explosive movement phases, motor control is largely governed by centrally mediated feedforward mechanisms that are organized prior to movement execution (41,42). Because muscle activation during this phase is initiated rapidly and within a very short time window, sensory information arising from external interventions such as taping may have limited opportunity to substantially modify ongoing motor output. Although taping may enhance proprioceptive feedback and alter afferent sensory input around the ankle joint , the influence of these sensory signals is likely constrained by the brief duration of the acceleration phase. Consequently, the central nervous system may rely predominantly on pre-planned motor commands rather than online sensory feedback to regulate muscle recruitment during this portion of the movement, as feedforward muscle activation is initiated before feedback-driven responses become fully engaged (43). Therefore, the absence of significant differences during the acceleration phase may reflect the limited opportunity for taping-related sensory effects to influence neuromuscular control during rapid and explosive movements.

Limitations

Several caveats should be acknowledged when interpreting the current findings. Notably, the modest participant cohort (n = 21) may have reduced the statistical sensitivity necessary to identify minor neuromuscular alterations. In addition, the study included only female participants, which limits the generalizability of the findings to male athletes. The absence of a sham or placebo taping condition also limits the ability to distinguish between sensory and mechanical effects of taping. Furthermore, no long-term follow-up was performed; therefore, the durability of the observed effects remains unknown.

Conclusion

The findings of this study suggest that elastic taping, including both DT and KT, can have immediate effects on the activation of the tibialis anterior, peroneus longus, and medial gastrocnemius muscles during the feedforward and deceleration phases of movement in athletes with CAI. Notably, DT resulted in a greater immediate reduction in muscle activity than KT. These findings indicate that DT may have potential as a supportive intervention for the short-term reduction of compensatory muscle activation in female athletes with CAI. Nevertheless, because only immediate effects were examined in the present study, the long-term effectiveness and clinical significance of this intervention remain unclear. Further research involving larger participant groups and extended follow-up assessments is warranted to verify the current findings and provide additional evidence regarding their consistency over time.

Ethical Considerations

Compliance with ethical guidelines

This study was approved by the Research Ethics Committee of Arak University (Code: IR.ARAKU.REC.1403.0564).

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Authors' contributions

Conceptualization and methodology: Zahra Raeisi and Solmaz Soleimani; Data collection: Solmaz Soleimani and Maryam Bazgir; Data analysis: Maryam Bazgir; Writing original draft, review, and editing: all authors. All authors read and approved the final manuscript.

Conflict of interest

The authors declared no conflict of interest.

AI Use Declaration

During the preparation and editing of this manuscript, we used ChatGPT and Grammarly solely for language polishing, grammar correction, and improving academic phrasing. Suggestions provided by these tools were reviewed and incorporated where appropriate. No AI tools were used for data analysis, interpretation of findings, scientific content generation, or drawing conclusions.

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References

1. Vuurberg G, Hoorntje A, Wink LM, Van Der Doelen BFW, Van Den Bekerom MP, Dekker R, et al. Diagnosis, treatment and prevention of ankle sprains: update of an evidence-based clinical guideline. Br J Sports Med. 2018 Aug 1;52(15):956. doi:10.1136/BJSPORTS-2017-098106 PubMed PMID: 29514819.

2. Halabchi F, Hassabi M. Acute ankle sprain in athletes: Clinical aspects and algorithmic approach. World J Orthop. 2020 Dec 1;11(12):534–58. doi:10.5312/WJO.V11.I12.534 PubMed PMID: 33362991.

3. Simpson JD, Koldenhoven RM, Wilson SJ, Stewart EM, Turner AJ, Chander H, et al. Lower extremity joint kinematics of a simulated lateral ankle sprain after drop landings in participants with chronic ankle instability. Sports Biomech. 2022;21(4):428–46. doi:10.1080/14763141.2021.1908414 PubMed PMID: 33896373.

4. Uzlasir S, Tayfur B, Işıkdemir E, Tayfur A. Comparison of muscle activation and proprioception during landing at different angles between individuals with chronic ankle instability and healthy controls. BMC Musculoskelet Disord. 2025 Dec 1;26(1). doi:10.1186/S12891-025-09212-8 PubMed PMID: 41063064.

5. McKeon PO, Stein AJ, Ingersoll CD, Hertel J. Altered plantar-receptor stimulation impairs postural control in those with chronic ankle instability. J Sport Rehabil. 2012;21(1):1–6. doi:10.1123/JSR.21.1.1 PubMed PMID: 22318247.

6. Migel K, Wikstrom E, Migel K, Wikstrom E. Neuromuscular Control Training Does Not Improve Gait Biomechanics in Those With Chronic Ankle Instability: A Critically Appraised Topic. International Journal of Athletic Therapy and Training. 2020 Feb 9;25(4):165–9. doi:10.1123/IJATT.2019-0014

7. Witchalls J, Waddington G, Blanch P, Adams R. Ankle instability effects on joint position sense when stepping across the active movement extent discrimination apparatus. J Athl Train. 2012 Dec;47(6):627–34. doi:10.4085/1062-6050-47.6.12 PubMed PMID: 23182010.

8. Di Giulio I, Maganaris CN, Baltzopoulos V, Loram ID. The proprioceptive and agonist roles of gastrocnemius, soleus and tibialis anterior muscles in maintaining human upright posture. J Physiol. 2009;587(Pt 10):2399–416. doi:10.1113/JPHYSIOL.2009.168690 PubMed PMID: 19289550.

9. Hale SA, Fergus A, Axmacher R, Kiser K. Bilateral improvements in lower extremity function after unilateral balance training in individuals with chronic ankle instability. J Athl Train. 2014;49(2):181–91. doi:10.4085/1062-6050-49.2.06 PubMed PMID: 24568231.

10. Kim KM, Kim JS, Grooms DR. Stroboscopic Vision to Induce Sensory Reweighting During Postural Control. J Sport Rehabil. 2017 Sep 1;26(5). doi:10.1123/JSR.2017-0035 PubMed PMID: 28605310.

11. DeJong AF, Koldenhoven RM, Hertel J. Hip biomechanical alterations during walking in chronic ankle instability patients: a cross-correlation analysis. Sports Biomech. 2022;21(4):460–71. doi:10.1080/14763141.2021.1884285 PubMed PMID: 33666150.

12. Simpson JD, Stewart EM, Macias DM, Chander H, Knight AC. Individuals with chronic ankle instability exhibit dynamic postural stability deficits and altered unilateral landing biomechanics: A systematic review. Physical Therapy in Sport. 2019 May 1;37:210–9. doi:10.1016/j.ptsp.2018.06.003 PubMed PMID: 29914742.

13. Lin JZ, Lin YA, Lee HJ. Are landing biomechanics altered in elite athletes with chronic ankle instability. J Sports Sci Med. 2019 Dec 1;18(4):653–62. PubMed PMID: 31827349.

14. Balasukumaran T, Gottlieb U, Springer S. Muscle activation patterns during backward walking in people with chronic ankle instability. BMC Musculoskelet Disord. 2020 Jul 25;21(1). doi:10.1186/S12891-020-03512-X PubMed PMID: 32711488.

15. Yu R, Shi X, Yang Z, El-ansary D, Adams R, Waddington G, et al. Kinesiology taping length and dynamic balance control in individuals with chronic ankle instability. Sci Rep. 2025 Dec 1;15(1). doi:10.1038/S41598-025-91357-6 PubMed PMID: 40164636.

16. Wang L, Chen P, Wang G, Zheng C. Effects of kinesio taping on chronic ankle instability: a systematic review and Meta-analysis. Chinese Journal of Tissue Engineering Research. 2023 May 18;27(14):2283. doi:10.12307/2023.427

17. McNeill W, Pedersen C. Dynamic tape. Is it all about controlling load? J Bodyw Mov Ther. 2016 Jan 1;20(1):179–88. doi:10.1016/J.JBMT.2015.12.009 PubMed PMID: 26891654.

18. Vered E, Oved L, Zilberg D, Kalichman L. Influence of kinesio tape application direction on peak force of biceps brachii muscle: A repeated measurement study. J Bodyw Mov Ther. 2016 Jan 1;20(1):203–7. doi:10.1016/J.JBMT.2015.04.004 PubMed PMID: 26891656.

19. Biz C, Nicoletti P, Tomasin M, Bragazzi NL, Di Rubbo G, Ruggieri P. Is Kinesio Taping Effective for Sport Performance and Ankle Function of Athletes with Chronic Ankle Instability (CAI)? A Systematic Review and Meta-Analysis. Medicina (Kaunas). 2022 May 1;58(5). doi:10.3390/MEDICINA58050620 PubMed PMID: 35630037.

20. Nunes GS, Feldkircher JM, Tessarin BM, Bender PU, da Luz CM, de Noronha M. Kinesio taping does not improve ankle functional or performance in people with or without ankle injuries: Systematic review and meta-analysis. Clin Rehabil. 2021 Feb 1;35(2):182–99. doi:10.1177/0269215520963846 PubMed PMID: 33081510.

21. Bijari K, Sadeghi H, Yousefi M. Evaluation of Peroneus Longus Muscle Force in Individuals With Chronic Ankle Instability During Gait Initiation. The Scientific Journal of Rehabilitation Medicine. 2025 Sep 23;14(4):606–17. doi:10.32598/SJRM.14.4.3354

22. Farzami A, Sadeghi H, Fatahi A. The Effect of Kinesio Taping on the Feedforward Activity of the Lower Limb Muscles in Elite Volleyball Players With and Without Chronic Ankle Instability Performing Single-leg Jump-landing. Physical Treatments - Specific Physical Therapy Journal. 2022 Oct 10;12(4):279–90. doi:10.32598/PTJ.12.4.547.1

23. McNeill W, Pedersen C. Dynamic tape. Is it all about controlling load? J Bodyw Mov Ther. 2016 Jan 1;20(1):179–88. doi:10.1016/j.jbmt.2015.12.009 PubMed PMID: 26891654.

24. Tran L, Makram AM, Makram OM, Elfaituri MK, Morsy S, Ghozy S, et al. Efficacy of Kinesio Taping Compared to Other Treatment Modalities in Musculoskeletal Disorders: A Systematic Review and Meta-Analysis. Res Sports Med. 2023;31(4):416–39. doi:10.1080/15438627.2021.1989432 PubMed PMID: 34711091.

25. Ataullah MG, Kapoor G, Alghadir AH, Khan M. EFFECTS OF KINESIO TAPING ON HIP ABDUCTOR MUSCLE STRENGTH AND ELECTROMYOGRAPHY ACTIVITY IN ATHLETES WITH CHRONIC ANKLE INSTABILITY: A RANDOMIZED CONTROLLED TRIAL. J Rehabil Med. 2021;53(6):2801. doi:10.2340/16501977-2845 PubMed PMID: 34013356.

26. Lins CA de A, Neto FL, Amorim ABC de, Macedo L de B, Brasileiro JS. Kinesio Taping® does not alter neuromuscular performance of femoral quadriceps or lower limb function in healthy subjects: Randomized, blind, controlled, clinical trial. Man Ther. 2013 Feb;18(1):41–5. doi:10.1016/j.math.2012.06.009 PubMed PMID: 22796389.

27. Gribble PA, Delahunt E, Bleakley CM, Caulfield B, Docherty CL, Fong DTP, et al. Selection Criteria for Patients With Chronic Ankle Instability in Controlled Research: A Position Statement of the International Ankle Consortium. J Athl Train. 2014 Jan;49(1):121. doi:10.4085/1062-6050-49.1.14 PubMed PMID: 24377963.

28. Annino G, Alashram A, Romagnoli C, Balducci E, De Paolis M, Manzi V, et al. Acute Effects of Kinesio Taping on Functional Performance in Healthy Soccer Players: A Randomized, Controlled Crossover Trial. J Funct Morphol Kinesiol. 2022 Mar 1;8(1). doi:10.3390/JFMK8010002 PubMed PMID: 36648894.

29. Dynamic Tape. How to apply: lateral ankle ligament [Internet]. Kew East (AU): Dynamic Tape; [cited 2026 Jun 7]. Available from: https://dynamictape.com/education/how-to-apply/.

30. Hermens HJ, Freriks B, Disselhorst-Klug C, Rau G. Development of recommendations for SEMG sensors and sensor placement procedures. J Electromyogr Kinesiol. 2000 Oct;10(5):361–74. doi:10.1016/S1050-6411(00)00027-4 PubMed PMID: 11018445.

31. Chua YK, Ang JRC, Wong JKH, Kwok BC. Electromyographic Validation of the DMA Clinical Pilates Method for Classifying Muscle Impairments in Chronic Ankle Instability. BioMed. 2025 Oct 2;5(4):23. doi:10.3390/BIOMED5040023

32. Webster KA, Pietrosimone BG, Gribble PA. Muscle Activation During Landing Before and After Fatigue in Individuals With or Without Chronic Ankle Instability. J Athl Train. 2016 Aug 1;51(8):629–36. doi:10.4085/1062-6050-51.10.01 PubMed PMID: 27626836.

33. Sarvestan J, Ataabadi PA, Svoboda Z, Kovačikova Z, Needle AR. The effect of ankle Kinesio™ taping on ankle joint biomechanics during unilateral balance status among collegiate athletes with chronic ankle sprain. Physical Therapy in Sport. 2020 Sep 1;45:161–7. doi:10.1016/j.ptsp.2020.06.007 PubMed PMID: 32781269.

34. Robinson NA, Spratford W, Welvaert M, Gaida J, Fearon AM. Does Dynamic Tape change the walking biomechanics of women with greater trochanteric pain syndrome? A blinded randomised controlled crossover trial. Gait Posture. 2019 May 1;70:275–83. doi:10.1016/j.gaitpost.2019.02.031 PubMed PMID: 30921578.

35. Fayson SD, Needle AR, Kaminski TW. The Effect of Ankle Kinesio Tape on Ankle Muscle Activity During a Drop Landing. J Sport Rehabil. 2015;24(4):391–7. doi:10.1123/JSR.2014-0221 PubMed PMID: 25310202.

36. . S, Ahmed R. Effectiveness of Kinesio Taping in Chronic Ankle Instability: An Update. Int J Health Sci Res. 2025 Jan 23;15(1):228–39. doi:10.52403/IJHSR.20250130

37. Yin L, Liu K, Liu C, Feng X, Wang L. Effect of Kinesiology Tape on Muscle Activation of Lower Extremity and Ankle Kinesthesia in Individuals With Unilateral Chronic Ankle Instability. Front Physiol. 2021 Dec 17;12. doi:10.3389/FPHYS.2021.786584/PDF

38. Johansson H. Role of knee ligaments in proprioception and regulation of muscle stiffness. J Electromyogr Kinesiol. 1991;1(3):158–79. doi:10.1016/1050-6411(91)90032-Z PubMed PMID: 20870507.

39. Halseth T, McChesney JW, Debeliso M, Vaughn R, Lien J. The effects of kinesio™ taping on proprioception at the ankle. J Sports Sci Med. 2004.

40. Walsh M, Boling MC, McGrath M, Blackburn T, Padua DA. Lower extremity muscle activation and knee flexion during a jump-landing task. J Athl Train. 2012 Aug;47(4):406–13. doi:10.4085/1062-6050-47.4.17 PubMed PMID: 22889656.

41. Santello M. Review of motor control mechanisms underlying impact absorption from falls. Gait Posture. 2005;21(1):85–94. doi:10.1016/j.gaitpost.2004.01.005 PubMed PMID: 15536038.

42. Fu SN, Hui-Chan CWY. Modulation of prelanding lower-limb muscle responses in athletes with multiple ankle sprains. Med Sci Sports Exerc. 2007 Oct;39(10):1774–83. doi:10.1249/MSS.0B013E3181343629 PubMed PMID: 17909405.

43. Peng H Te, Chang HK, Chen HW, Huang TI, Chen H. Neuromuscular Changes in Drop Jumps on Different Common Material Surfaces with Incremental Drop Heights. Applied Sciences 2023, Vol 13, Page 5123. 2023 Apr 20;13(8):5123. doi:10.3390/APP13085123