# Using Ankle Bracing and Taping to Decrease Range of Motion and Velocity During Inversion Perturbation While Walking

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**Context:** Prophylactic ankle supports are commonly used. However, the effectiveness of external supports in preventing an inversion stress has been debated.

**Objective:** To evaluate how ankle bracing and taping affect inversion range of motion, time to maximum inversion, inversion velocity, and perceived ankle stability compared with a control condition during a dynamic inversion perturbation while walking.

Design: Crossover study.

Setting: Research laboratory.

**Patients or Other Participants:** A total of 42 physically active participants (16 men, 26 women; age =  $21.2 \pm 3.3$  years, height =  $168.9 \pm 8.9$  cm, mass =  $66.1 \pm 11.4$  kg) volunteered.

**Intervention(s):** Participants walked on a custom-built walkway that suddenly inverted their ankles to  $30^{\circ}$  in 3 conditions: brace, tape, and control (no external support). We used an ASO ankle brace for the brace condition and a closed basketweave technique for the tape condition. Three trials were completed for each condition.

*Main Outcome Measure(s):* Maximum inversion (degrees), time to maximum inversion (milliseconds), and inversion velocity (degrees per second) were measured using an electrogoniom-

eter, and perceived stability (centimeters) was measured using a visual analog scale.

**Results:** Maximum inversion decreased more in the brace condition (20.1°) than in the control (25.3°) or tape (22.3°) conditions (both *P* values = .001), and the tape condition restricted inversion more than the control condition (*P* = .001). Time to maximum inversion was greater in the brace condition (143.5 milliseconds) than in the control (123.7 milliseconds; *P* = .001) or tape (130.7 milliseconds; *P* = .009) conditions and greater in the tape than in the control condition (142.6°/s) than in the control (209.1°/s) or tape (174.3°/s) conditions (both *P* values = .001) and slower in the tape than in the control condition (*P* = .02). Inversion velocity was slower in the tape than in the control condition (142.6°/s) than in the control (209.1°/s) or tape (174.3°/s) conditions (both *P* values = .001). Both the brace and tape conditions provided more perceived stability (0.98 cm and 0.94 cm, respectively) than the control condition (2.38 cm; both *P* values = .001).

**Conclusions:** Both prophylactic conditions affected inversion range of motion, time to maximum inversion, inversion velocity, and perceived ankle stability. However, bracing provided more restriction at a slower rate than taping.

Key Words: ankle sprains, prophylaxis, dynamic walkway

#### **Key Points**

- The brace condition provided a greater benefit than the tape or control conditions for inversion range of motion, time to maximum inversion, and inversion velocity.
- Reducing the amount of, time to, and velocity of inversion may allow the body's protective mechanism to respond
  and potentially reduce the risk of an ankle sprain.
- The brace and tape conditions improved the participants' perceptions of stability during the walking perturbation trials.

he incidence of ankle sprains is high in both the athletic<sup>1-3</sup> and general populations,<sup>4,5</sup> with an estimated 23 000 ankle sprains occurring daily.<sup>6</sup> These injuries often lead to chronic ankle instability<sup>7-9</sup> and residual symptoms that can alter physical health by causing patients to become less active in their lifetime.<sup>10</sup> To prevent initial and recurrent ankle sprains, prophylactic taping and bracing have become common practices in sports medicine.<sup>11</sup> Several prospective randomized controlled trials<sup>12-18</sup> have been conducted to examine whether bracing or taping can reduce the occurrence of ankle sprains. In the earliest randomized controlled trial, Garrick and Requa<sup>12</sup> reported that ankle taping decreased the incidence of ankle sprain compared with no support. Since then, other researchers<sup>13-16,18</sup> have demonstrated that ankle braces effectively decreased

the incidence of lateral ankle sprains compared with no external support in individuals with a history of ankle injuries. Investigators<sup>19–23</sup> have theorized that prophylactic ankle supports reduce injuries by decreasing the available range of motion (ROM) in the joint, especially in the extremes. However, given the inability to collect joint kinematic data in practices and games when injuries occur, the effectiveness of each prophylactic support needs to be examined with kinematic measures during a simulated inversion perturbation.

Many researchers<sup>24–30</sup> have evaluated the effectiveness of external ankle supports using a standing sudden-inversion platform. Yet this static model may not accurately simulate how an ankle sprain typically occurs. Hopkins et al<sup>31</sup> found that inversion perturbation during walking was a more

appropriate model when trying to safely recreate the mechanism of a lateral ankle sprain. This model has been used in an array of studies,<sup>31–37</sup> but to date, no one has examined how external ankle supports affect ROM during a sudden-inversion perturbation while walking. Therefore, the purpose of our study was to evaluate the effect of ankle taping and bracing on the maximum amount of inversion ROM, time to maximum inversion, rate of maximum inversion, and perceived ankle stability compared with a control condition during a dynamic perturbation task while walking.

# METHODS

We conducted a crossover study with 1 independent variable (prophylactic condition at 3 levels: brace, tape, and control) and 4 dependent variables (maximum inversion, time to maximum inversion, inversion velocity, and perceived ankle stability).

### **Participants**

A total of 42 physically active participants (16 men, 26 women; age =  $21.2 \pm 3.3$  years, height =  $168.9 \pm 8.9$  cm, mass =  $66.1 \pm 11.4$  kg) volunteered. We defined *physically active* as being involved in physical activity for at least 120 minutes per week at a moderate intensity. Given that taping and bracing are used for athletes both with and without a history of ankle sprains, we recruited participants with similar histories (ankle sprains =  $1.07 \pm 1.52$ , range = 0-5). Participants were excluded only if they had a history of lower extremity surgery or fracture, had been involved in formal rehabilitation within the 3 months before the study, or had a neurologic or balance-affecting condition. The study was approved by the Institutional Review Board for the Protection of Human Subjects at Indiana University, and all participants provided written informed consent.

# Procedures

Participants wore a standardized shoe (Excelsior training shoe; Adidas AG, Herzogenaurach, Germany) for all testing conditions to ensure that they had the same shoe-surface interface during testing. To minimize movement within the shoe, we instructed participants to tie their shoes tightly. An electrogoniometer (model SG110/A; Biometrics Ltd, Newport, United Kingdom) was placed on the right lateral ankle just proximal to the distal fibula, and the distal axis was placed on the shoe at the subtalar joint. We secured it with hook-and-loop tape and medical tape as recommended by the manufacturer. The right ankle was assessed in all participants. Before testing each participant, we used the software to calibrate the electrogoniometer with a standard goniometer at  $0^{\circ}$ and 30°. Participants walked along a custom-built walkway in 3 conditions: brace, tape, and control. The order of prophylactic condition was counterbalanced. Participants rested for 30 seconds between trials and 2 to 5 minutes between conditions. They completed at least 5 walking trials to provide 3 acceptable test trials for each condition. After each condition, we instructed participants to rate their perceived ankle stability during the condition using a visual analog scale. They marked a dash across a vertical 10-cm line, with 0 cm (top)



Figure 1. When triggered, the active door opened to approximately  $30^\circ$  of inversion when participants stepped on it. Participants were instructed to keep walking after the sudden perturbation occurred.

indicating that the ankle felt *completely stable* and 10 cm (bottom) indicating that the ankle felt *very unstable* during the condition.

All data collection was completed on the custom-built 7.2-m-long walkway, which was modeled after the device used by Hopkins et al.<sup>31,32,38</sup> It included four 1.2-m active sections with a set of doors on the right and left that opened to a 30° angle. An industrial-strength electromagnet held each door closed. When triggered by a control panel, the voltage supplied to 1 electromagnet decreased to a set point at which it supported only the weight of the door. The instant a force greater than the weight of the door was applied, the door fell open (Figure 1).

We instructed participants to walk along the marked nonslip path at the pace of a metronome (model MA-1; KORG Inc, Tokyo, Japan) set to 110 beats per minute while focusing on a target mounted at eye level on the wall at the end of the walkway. During each walking trial, 1 random door was triggered to open. Participants were instructed to keep walking and to take the next step or steps when a door opened. We collected data from the time the participants were instructed to begin walking until they reached the end of the walkway, which was approximately 10 seconds. Whereas data were recorded only for the right side, the randomization of doors included the right and left sides, so participants were unaware of which door would open. All trials were video recorded (LifeCam Studio webcam; Microsoft Corpora-



Figure 2. Participants performed all 3 conditions. A, Brace. B, Tape. C, Control.

tion, Redmond, WA); if we questioned whether the participant was not completely within the footpath or a door did not trigger, the trial was flagged for video review before the data were included in the analysis.

#### Conditions

**Bracing.** For the bracing condition, we used the ASO Ankle Stabilizer (Medical Specialties, Inc, Charlotte, NC). This lace-up brace has nylon straps that lock around the calcaneus. Each participant was fitted based on shoe size according to the manufacturer's guidelines (Figure 2A).

Taping. Tape was applied using a modified closedbasketweave technique. A single investigator (E.A.H.) applied the tape to all participants. Two foam heel-andlace pads with a small amount of skin lubricant were placed over the anterior ankle at the mortise and over the Achilles tendon on the posterior ankle. The ankle was sprayed liberally with adhesive spray (Tuf-Skin; Cramer Products Inc, Gardner, KS) over the foot and lower leg. When the adhesive was dry, the investigator applied underwrap (Pro Trainer Underwrap; Medco Athletics, Tonawanda, NY), starting at the midfoot and circling the lower leg to the base of the gastrocnemius. Next, 1.5-in (3.81-cm) linen tape (ZONAS athletic tape; Johnson & Johnson Consumer Inc, Bridgewater, NJ) was applied. No tape was applied directly to the skin. The investigator applied a single anchor strip, starting at the midfoot and circling the lower leg to the base of the gastrocnemius. In an alternating fashion, 3 stirrups and 3 horseshoe strips were applied in a medial to lateral direction. Several closure strips, which varied in number based on the participant's leg length, were added between the horseshoe strips and the anchor strips at the base of the gastrocnemius. Two figure-of-8s and 2 heel locks (1 on each side) were applied. The investigator added several more closure strips, starting at the most superior portion of the figure-of-8s and heel locks and moving up the leg toward the anchor strip at the base of the gastrocnemius. Two more anchor strips were applied at the base of the gastrocnemius, and 1 was applied at the midfoot to finish the taping (Figure 2B).

**Control.** In the control condition, participants did not wear any tape or brace (Figure 2C).

#### **Data Processing**

All data were collected using AcqKnowledge software (version 4.1; Biopac Systems, Inc, Goleta, CA) and imported into MATLAB (version R2013a; MathWorks, Natick, MA) for processing of the maximum inversion, time to maximum inversion, and inversion velocity for each trial. All electrogoniometer data were filtered using a fourth-order, low-pass, zero-lag Butterworth filter. Maximum inversion (°) was calculated by subtracting the maximum degree of inversion in the 250-millisecond window after the door opened from the degree of inversion 2 milliseconds before the door opened. *Time to maximum* inversion was calculated as the time in milliseconds from the door opening to the maximum inversion. Inversion velocity (degrees per second) was calculated as the maximum inversion divided by the time to reach maximum inversion after the door opened. A graphical representation of 1 trial from each condition identifies the variables that were obtained from the data (Figure 3). For perceived ankle stability, the investigator measured the distance (in centimeters) from the top of the visual analog scale to the participant's mark. A smaller value indicated a more stable ankle.

# **Statistical Analysis**

A repeated-measures multivariate analysis of variance (MANOVA) with 1 within-subject factor at 3 levels (brace, tape, and control conditions) was performed on all dependent variables (maximum inversion, time to maximum inversion, inversion velocity, and perceived stability). We conducted univariate analyses of variance on any findings that were different and then performed a Bonferroni post hoc test. Effect sizes were also calculated using a bias-corrected Hedges g with corresponding 95% confidence intervals (CIs).<sup>39</sup> Effect sizes were interpreted as weak ( $\leq 0.39$ ), moderate (0.40–0.69), or strong ( $\geq 0.70$ ).<sup>40</sup> The  $\alpha$  level was set a priori at .05. All data were imported into SPSS (version 22; IBM Corporation, Armonk, NY) for statistical analysis.

# RESULTS

Descriptive statistics for maximum inversion, time to maximum inversion, inversion velocity, and perceived stability per condition are provided in the Table. The



Figure 3. A graphical representation of 1 trial from each condition.

repeated-measures MANOVA revealed a significant effect on all dependent variables (Wilks  $\Lambda = 0.21$ ,  $F_{8,34} = 16.24$ , P = .001;  $\eta_p^2 = .79$ , power = 1.00). For the univariate analyses, differences occurred among the tape, brace, and control conditions for maximum inversion ( $F_{2,82} = 47.25$ , P = .001;  $\eta_p^2 = .54$ , power = 1.00), time to maximum inversion ( $F_{2,82} = 14.42$ , P = .001;  $\eta_p^2 = .26$ , power = .99), inversion velocity ( $F_{2,82} = 52.50$ , P = .001;  $\eta_p^2 = .56$ , power = 1.00), and perceived stability ( $F_{2,82} = 20.46$ , P = .001;  $\eta_p^2 = .33$ , power = 1.00).

#### Maximum Inversion

Post hoc analysis revealed that the brace condition provided a greater restriction on maximal inversion ROM than the control condition (difference =  $5.28^{\circ} \pm 0.58^{\circ}$ ; 95% CI =  $3.84^{\circ}$ ,  $6.72^{\circ}$ ; P = .001; g = 1.22; 95% CI for effect size = 0.76, 1.69) or tape condition (difference =  $2.30^{\circ} \pm 0.55^{\circ}$ ; 95% CI =  $0.93^{\circ}$ ,  $3.67^{\circ}$ ; P = .001; g = 0.54; 95% CI for effect size = 0.11, 0.98). The tape condition also restricted more inversion ROM than the control condition (difference =  $2.98^{\circ} \pm 0.51^{\circ}$ ; 95% CI =  $1.72^{\circ}$ ,  $4.24^{\circ}$ ; P = .001; g = 0.69; 95% CI for effect size = 0.25, 1.13).

#### **Time to Maximum Inversion**

After pairwise comparisons, we observed that time to maximum inversion was greater in the brace than in the control condition (difference =  $19.81 \pm 4.45$  milliseconds;

95% CI = 8.71, 30.92 milliseconds; P = .001; g = 0.91; 95% CI for effect size = 0.46, 1.36) or the tape condition (difference = 12.77 ± 4.06 milliseconds; 95% CI = 2.62, 22.91 milliseconds; P = .009; g = 0.61; 95% CI for effect size = 0.17, 1.05). It was also greater in the tape than in the control condition (difference = 7.05 ± 2.38 milliseconds; 95% CI = 1.12, 12.98 milliseconds; P = .02; g = 0.37; 95% CI for effect size = -0.06, 0.80).

#### **Inversion Velocity**

Inversion velocity was slower in the brace than in the control condition (difference =  $66.0^{\circ}/s \pm 7.0^{\circ}/s$ ; 95% CI =  $49.0^{\circ}/s$ ,  $84.0^{\circ}/s$ ; P = .001; g = 1.58; 95% CI for effect size = 1.09, 2.07) or the tape condition (difference =  $32.0^{\circ}/s \pm 6.0^{\circ}/s$ ; 95% CI =  $17.0^{\circ}/s$ ,  $47.0^{\circ}/s$ ; P = .001; g = 0.83; 95% CI for effect size = 0.39, 1.28). It was also slower in the tape than in the control condition (difference =  $35.0^{\circ}/s \pm 6.0^{\circ}/s$ ; 95% CI =  $19.0^{\circ}/s$ ,  $50.0^{\circ}/s$ ; P = .001; g = 0.77; 95% CI for effect size = 0.33, 1.21).

#### **Perceived Stability**

Participants reported greater stability during the control than the brace condition (difference =  $1.41 \pm 0.31$  cm; 95% CI = 0.78, 2.04 cm; P = .001; g = 4.76; 95% CI for effect size = 3.92, 5.60) or the tape condition (difference =  $1.44 \pm 0.30$  cm; 95% CI = 0.83, 2.05 cm; P = .001; g = 4.99; 95% CI for effect size = 4.12, 5.86). No difference in

Table.	Descriptive	Statistics	by	Condition	(Mean	$\pm$	SD	)
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	Condition				
Variable	Brace	Tape	Control		
Maximum inversion, °	20.1 ± 3.9ª	22.3 ± 4.1 <sup>b</sup>	$25.3\pm4.5$		
Time to maximum inversion, ms	$143.5 \pm 23.3^{a}$	$130.7 \pm 18.1^{b}$	123.7 ± 19.5		
Inversion velocity, °/s	$142.6 \pm 33.8^{a}$	$174.3 \pm 41.2^{b}$	209.1 ± 48.2		
Visual analog scale of perceived stability, cm	$0.98~\pm~0.20^{b}$	$0.94 \pm 0.18^{b}$	$2.38\pm0.36$		

<sup>a</sup> Indicates difference from the tape and control conditions (P < .05).

<sup>b</sup> Indicates difference from the control condition (P < .05).

perceived stability was observed between the brace and tape conditions (difference =  $0.04 \pm 0.10$  cm; 95% CI = -0.17, 0.24 cm; P = .72; g = 0.21; 95% CI for effect size = -0.22, 0.64).

# DISCUSSION

Our overall findings were that the brace and tape conditions improved the maximal amount of inversion ROM, time to inversion, and inversion velocity compared with the control condition. In addition, the brace and tape improved participants' perception of stability. When evaluating the 2 prophylactic conditions, we observed that the brace condition restricted a greater amount of inversion ROM, increased the time to inversion, and decreased the inversion velocity during the dynamic perturbation task compared with the tape condition. Perceived stability did not differ between the brace and tape conditions. Several researchers<sup>25,26,30,41-44</sup> have also confirmed the improvements in kinematic outcome measures after the application of prophylactic support. We propose that the improvements in these measures may be partly due to the mechanical properties of the brace and tape, particularly the differences in tensile strength of the different fabrics. These mechanical properties may give the peroneal muscles more time to contract in order to prevent the inversion mechanism.

Tape grade is determined by the number of fibers per inch; heavier, more costly tapes have more fibers. The effectiveness of athletic tape depends on the different properties of the fabric and the adhesive strength of the tape.<sup>45</sup> It should adhere readily to the skin or prewrap and maintain adherence in the presence of perspiration.45,46 When tape is applied to a joint, it is subjected to 4 types of stress: tension, shear, peel, and cleavage. In general, more stress is required to cause failure in shear and tensile situations.<sup>47</sup> The tape that we used had approximately 36 threads per 2.54 cm.<sup>48</sup> The highest average tensile strength is measured in pound-force per square inch (psi). The tape brand we used measured 97 474 psi, which is in the middle range of tensile strength; other brands provide more (Cramer; 115818 psi) or less (Mueller Sports Medicine, Inc, Prairie du Sac, WI; 75358 psi) strength.<sup>47</sup> Whereas tape is frequently used in athletes, it has several drawbacks, including its tendency to stretch and loosen as a player moves, potentially decreasing its effectiveness in supporting the ankle over time.<sup>45</sup> This loosening of the tape is exacerbated when an individual perspires, which causes the tape to become wet.<sup>48</sup> Finally, the application of tape to the skin or to a type of prewrap might also affect its restrictive capabilities.4

Conversely, ankle braces have been designed to overcome many of the problems related to conventional ankle taping and to reduce ankle injuries. The ankle brace that we used is composed of a nonelastic material woven of ballistic nylon. This fabric is lightweight while providing a high degree of strength and durability due to its tensile strength of approximately 430 000 psi,<sup>49</sup> which is more than any tape manufactured. Therefore, the fabric used in the brace is stronger than the athletic tape. In our study, the increased tensile strength of the brace may have contributed to the differences in the kinematic outcome measures. Specifically, the brace condition had a strong effect (g = 1.22) on decreasing inversion ROM compared

with the control condition, whereas the tape condition produced only a moderate effect (g = 0.69) compared with the control condition. This is in agreement with the observations of researchers<sup>25,50</sup> who also reported that the tape condition restricted ROM compared with the control condition; however, in our study, the brace condition restricted ROM more than the tape condition. Therefore, our observation adds evidence to support the effectiveness of ankle bracing over taping during a functional task. In the comparable studies, the investigators used a standing sudden-inversion platform or a drop landing onto an inverted surface to induce an inversion moment, whereas we used a dynamic walking platform. A static model may not accurately simulate how an ankle sprain typically occurs.

Our results indicated that the brace condition produced a slower rate of inversion than the tape and control conditions. Specifically, the brace condition had a strong effect (g = 0.91) compared with the control condition, and whereas different, the tape condition had only a weak effect (g = 0.37) in decreasing the time to maximum inversion compared with the control condition. Therefore, results related to the effectiveness of the taping condition in decreasing the time to maximum inversion should be interpreted with caution. Researchers have often suggested that the ankle evertors (peroneal muscles) can protect the ankle joint from inversion-induced trauma.<sup>17,51-53</sup> This is especially true when the ankle musculature is preactivated to provide initial stiffness to the joint before ground contact during running,<sup>54,55</sup> landing,<sup>56</sup> and cutting.<sup>57</sup> However, most ankle sprains are caused by stepping or landing on an unexpected object underneath the foot. The potential for ligamentous injury to the ankle is high when the rate and magnitude of ankle loading exceed the response time of the dynamic structures.<sup>58</sup> The peroneals alone may provide only limited protection from an inversion injury, depending on the rate and magnitude of the force. Konradsen et al<sup>59</sup> proposed that the minimum time for the neuromuscular system to perceive an unexpected inversion event and generate a protective muscular response is about 120 milliseconds. Most injuries occur in less than 100 milliseconds.<sup>59</sup> A prophylactic device may decrease the rate or magnitude of inversion; therefore, the peroneals would have a greater potential to prevent or at least decrease the severity of the injury.

We found that the brace and tape conditions resulted in slower inversion velocity than the control condition. The brace condition was strongly effective at decreasing the inversion velocity compared with both the tape (g = 0.83) and control (g = 1.58) conditions. The tape condition was also strongly effective at decreasing the inversion velocity compared with the control condition (g = 0.77). Based on the research of Ricard et al,<sup>26,60</sup> Trégouët et al,<sup>30</sup> and Vaes et al,<sup>61</sup> the slower inversion velocity and time to maximum inversion allow the muscles of the ankle and lower leg additional time to activate and potentially protect the joint from a more severe inversion injury. The rate at which the ankle inverts may be a key factor resulting in an ankle injury. Other factors that should be considered include the magnitude and direction of the forces and neuromuscular preactivation.<sup>26,60</sup> Researchers<sup>25,51</sup> have stated that a slower inversion velocity allows a greater chance for the evertor

muscles to respond to the inversion in time to protect the ankle joint. Investigators<sup>25,62</sup> have also reported that the addition of a brace or tape can double the force required to further invert the ankle past  $15^{\circ}$ . Our data support these findings.

Researchers<sup>19,63</sup> who examined participants' perceived stability during a balance task observed differences when ankle braces were worn. They regarded the stabilizing effect of an ankle brace as the first priority and proposed the subjective perception as a source of influence. Gross et al<sup>64</sup> evaluated this aspect of perceived stability and concluded that the patients' individual preferences, based on subjective perception, strongly influenced the effectiveness of an ankle brace. Recently, authors of 3 studies<sup>65–67</sup> have shown that ankle taping can increase perceptions of stability, confidence, and reassurance when participants perform functional balance tests. Similar results were illustrated in our study as participants had an increased perception of stability when wearing the brace or tape. Specifically, we observed a strong effect in both the brace (g = 4.76) and tape (g = 4.99) conditions compared with the control condition. Researchers<sup>13,14</sup> have shown that ankle braces can reduce the incidence of ankle sprains, and based on our research, individuals also feel more stable when wearing an ankle brace.

Our study had several limitations, including the properties of the brace and tape, shoe worn, instrumentation, and sampling procedures. The effectiveness of bracing and taping may depend heavily on the design, type, application, and material used. In addition, the perturbation created in our study was restricted to strict inversion with no plantar flexion. How the addition of plantar flexion might affect the ability of the prophylaxis device to restrict ROM is unknown. The shoes were used to control for variability in the shoe-surface interface, but they were not standard athletic sneakers or high tops, and our findings may not translate to other types of athletic shoes. In addition, the placement of the electrogoniometer on the outside of the shoe is a limitation. It is not clear if true subtalar joint ROM was captured without the electrogoniometer being placed directly on the skin. Another limitation of our study was the lack of a homogeneous sample, as participants' ankle-sprain histories were not controlled. However, the heterogeneity of the sample allowed us to improve the external validity of our findings.

Whereas our study had limitations, we are the first to use a dynamic walking platform in the investigation of prophylactic devices. In future studies, researchers should introduce exercise and determine if the restriction and inversion velocity change over time or after exercise. Recreating a similar study with individuals who have laxity will provide further insight into the differences in individuals with and without ankle sprains. We recommend that when assessing the effectiveness of bracing and taping in a simulated ankle sprain, researchers should continue to use the advanced model (dynamic walkway) to obtain accurate measurements.

# CONCLUSIONS

Whereas both prophylactic techniques were effective, the brace condition produced a greater benefit for inversion

ROM, time to maximum inversion, and inversion velocity than the control and tape conditions. The reduction in the amount of, time to, and velocity of inversion may allow the body's protective mechanisms to respond and possibly reduce the potential for sustaining an ankle sprain. In addition, both the brace and tape conditions appeared to improve participants' perceptions of stability during the walking perturbation trials.

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