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# Effects of Ankle Taping and Bracing on Agility, Vertical Jump, and Power

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## ABSTRACT

Ankle sprains are the most common injuries in athletics. Ankle bracing and taping are widely used in order to prevent ankle injuries. The primary purpose of this study was to examine the effects of ankle taping and bracing on agility, maximum vertical jump height, and vertical power. The secondary purpose was to determine if there were performance differences in training status (athletic vs. non-athletic) among the ankle conditions. Nineteen participants (11 male, 8 female, age 20.6±1.52 yr, height 173.7±11.9 cm, mass 77.3±18 kg) from a Division II university volunteered to participate in this study. Of the 19 participants, 10 were classified as athletic and 9 were non-athletic. Subjects completed the same tests for each condition (control, braced, and taped) and the conditions were counter-balanced. The tests were a countermovement standing maximum vertical jump (MVJ), vertical jump displacement test (VJD), and the Illinois Agility test (IA). The VJD was used to calculate vertical power. There were no significant differences among conditions for the MVJ test ($P = 0.79$), power from the VJD test ($P = 0.10$) or the IA test ($P = 0.43$). There were statistically significant differences in training status (athletic vs. non-athletic) for all measurements ($P < 0.05$). The athletic group out performed the non-athletic group on agility, vertical jump, and power. However, there was not a difference among conditions and training status ($P > 0.05$). According to these results, ankle bracing or taping does not significantly impair agility, vertical jump, or power performance.

**Keywords:** functional performance; prophylactic taping; prophylactic bracing; Illinois Agility test; athletic; non-athletic

Ankle sprains are the most common injury found in athletics today (Beriau et al. 1994; Bocchinfusso et al.1994; Quackerbush et al. 2008). Sprains can occur when a joint has inverted, or everted past the joints' normal range of motion, although the sprain that most commonly occurs is from an inverted motion (Prentice 2013). In order to facilitate the healing process and also prevent ankle sprains, different types of ankle taping have been employed. Ankle taping consists of using different types of athletic tape and applying it to a persons' ankle to provide stability. This method has been preferred by athletes and athletic trainers because it may offer more comfort and support than ankle braces while offering less restriction at the ankle joint (Sanioglu et al. 2009).

Ankle bracing is also an employed technique to protect previously injured ankles and/or prevent ankle injuries. Some people prefer this method because while the braces provide support similar to the taping method, they are also re-usable and therefore, are more economically efficient (Beriau et al. 1994). Athletic trainers may also recommend ankle bracing for their athletic teams, as they may not travel to sporting events with the team. In addition, the athletic trainer on site may use a different ankle taping technique or tape; this could possibly hinder the athletes' performance or make them more susceptible to injury.

Traditionally, ankle taping and bracing have been applied as a protective measure following an injury. It can also be seen as a preventative measure for reoccurring ankle

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injuries by limiting the joint's active range of motion (ROM) (Cordova et al. 2010; Gehlsen et al. 1991; Verhagen et al. 2001). Cordova et al. (2010) reported that semi-rigid ankle braces limit ankle ROM more than taping. Since ankle taping and bracing have been shown to decrease ROM it is important to examine the effects on functional movement tasks associated with sports.

In a review by Wilkerson (2002), it was reported that vertical jump height is decreased by 3-5% when the ankle was supported via taping and/or bracing. However, other studies have shown ankle taping (Abián-Vicén et al. 2008) and bracing (Bocchinfuso et al. 1994) do not impair jumping performance. Paris (1992) also reported no differences in speed, balance, or agility in male soccer players when the ankles were taped or braced.

The inconsistent findings related to functional movement tasks when the ankle is taped or braced may be attributed to the variability in the design of the projects as well as the type of tasks selected. Additional research is needed to further assess the benefits or consequences of ankle taping and bracing during sport specific movements. Further, the majority of the studies reported have sampled an athletic population in sports commonly employing ankle taping and bracing. While this is an important contribution to the literature, very few studies have examined the effects of ankle taping or bracing in a non-athletic sample.

The primary purpose of this study was to investigate the effects of ankle taping and bracing on agility, maximum vertical jump height, and vertical power in young adults. The secondary purpose was to determine if there were performance differences among an athletic vs. non-athletic sample under the various ankle conditions. It was hypothesized there would be a significant difference in maximum vertical jump height, power output, and agility for the three ankle conditions. More specifically, it was postulated the brace condition would have the least favorable results and the athletic group would outperform the non-athletes on all tests.

## METHODS

### Subjects

Twenty-two students from Shippensburg University volunteered to participate in this study and signed a written informed consent. However, three participants did not complete the study therefore their data were not used in the analysis. Subjects included 10 (8 males, 2 females) collegiate athletes from a Division II sanctioned sport and 9 (3 males, 6 females) non-athletic students who participated in less than 60 min of physical activity daily (Table 1). Subjects were recruited via word of mouth; which may have influenced the number of males and females in the study. While an attempt was made to recruit an equal number of males and females there were scheduling conflicts, which decreased the overall number of participants. Further, subjects were screened for previous injuries to the lower extremity. Potential subjects were excluded from participation if they experienced any injury within the past 6 months. The Shippensburg University Committee on Research on Human Subjects approved this study.

### Procedures

Prior to testing, height (cm) and mass (kg) of each subject was recorded. All subjects completed the same tests for each condition (control, taped, and braced) and the order of the conditions was counter-balanced. For the taped condition, the same certified athletic trainer applied a closed-basket weave ankle taping application using 1.5 inch Coach (Johnson and Johnson) athletic tape. Standard lace-up braces (Mueller, Mueller Sports Medicine, Inc. Prairie du Sac, WI) were used for the braced condition. No bracing or taping application was applied to the ankles for the control condition. All conditions were applied bilaterally.

Subjects were asked to perform the same warm-up on each testing session and encouraged to complete the same exercise regimen as completed before, if any, on testing days. Subjects were given the option of completing one of two warm-ups, either: (1) a 3-5 min warm-up on a cycle ergometer (Monarch 828e, Sweden) at 0.5 kp maintaining 60-70 revolutions per min or (2) a

**Table 1**. Descriptive (M±SD) characteristics of the subjects (n = 19)

| | Age (yrs) | Height (cm) | Mass (kg) |
|---|---|---|---|
| Athletic (n = 10) | 21.1±1.5 | 178.6±12.4 | 81.5±19.7 |
| Female (n = 2) | 21.0±0.0 | 160.5±9.2 | 56.1±1.5 |
| Male (n = 8) | 21.1±1.6 | 183.1±11.9 | 87.9±16.3 |
| Non-Athletic (n = | 20.1±1.5 | 168.2±9.2 | 72.6±15.8 |
| Female (n = 6) | 20.7±1.2 | 163.8±7.4 | 66.4±12.5 |
| Male (n = 3) | 19.0±1.7 | 177.2±4.5 | 85.7±16.1 |

track & field warm-up. All subjects performed the same selected warm-up after the ankle intervention was applied for each testing session. Then the subject completed three anaerobic tests: (1) Maximal Vertical Jump (MVJ), (2) Vertical Jump Displacement (VJD) and (3) Illinois Agility Test (IA). Prior to the data collection periods, all subjects were required to attend one familiarization period. This session was designed to introduce the subjects to all three performance tests.

Lastly, subjects performed the IA 2 times with a 1-min rest period given in between each trial. The best MVJ and the fastest IA were both used for data analysis. Before data collection began subjects were allowed into the lab for a familiarization period. All data collection sessions were performed at Henderson Gymnasium at Shippensburg University.

***Maximal Vertical Jump.*** The MVJ was measured using a Vertec (Sports Imports., Hilliard, OH). The subject's standing reach height was determined by placing the lowest marker above their dominant hand. Subjects were instructed to perform the MVJ from a standing position using their arms and legs to jump as high as possible. The MVJ was performed 3 times with a 30 s rest period given between each trial. In order for the jump to count, the subject was required to take off and land using both feet.

***Vertical Jump Displacement.*** Following the MVJ, all subjects completed one trial of the VJD for each condition. For the VJD the subjects' standing reach height was found by raising their dominant arm to a tape measure (cm) against a wall. When the subject was ready they were instructed to jump as high as they could every 2 s for 30 s. A metronome was used to set the pace for the jumps. Their jump height was recorded and used to find their vertical displacement by subtracting their standing reach height. The average vertical displacement and mass of the subject was used to calculate force generated. Power was then calculated using average vertical displacement, body weight in N, and time.

***Illinois Agility test.*** The IA was performed on a 10 m by 5 m course. The IA begins with the subject lying in a prone position on the floor. On the command of the researcher, the subject ran straight ahead for 10 m and then looped around the first cone running back to the baseline before performing figure eights through four cones set in the middle at 3.3 m apart. Once the subject finished the figure eights, they ran 10 m and looped around a second cone on the opposite side and sprinted back to the baseline. The stopwatch was started on the command "go" and was stopped once the subjects' torso crossed the finish line. The IA was performed twice with a 1 min rest between trials.

### Data Analysis

The data were analyzed using descriptive statistics and M±SD were reported for all variables (IBM SPSS Statistics, v. 21, Chicago, IL). The best height from the MVJ and the fastest times from the IA test were used for data analysis. The dependent variables (MVJ, VJD, and IA) were analyzed using 2 (training status) x 3 (conditions) ANOVA with a repeated measure across the conditions. Significance was set at $\alpha < 0.05$.

## RESULTS

No statistical difference was observed among the groups on age, height, or mass. There was no significant interaction in the MVJ among the conditions and training status ($F = 1.62$, $P = 0.21$). However, there was a significant main effect for training status (F =

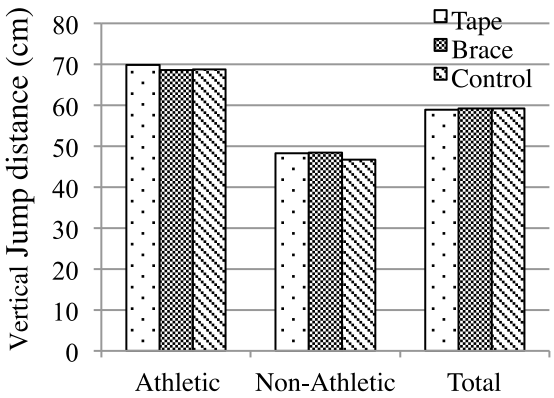


**Figure 1.** There was no significant difference among the conditions on maximum vertical jump height (cm). The athletic grouped jumped significantly higher than the non-athletic group for all three conditions.

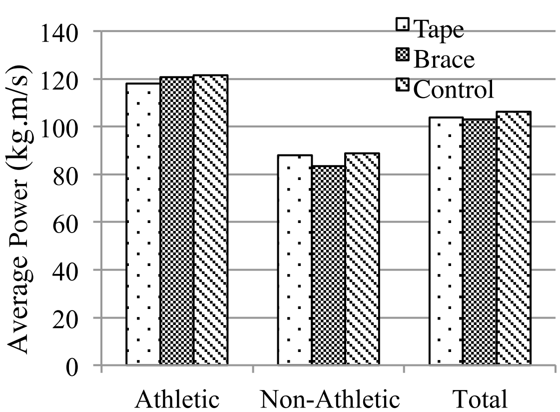


**Figure 2.** There was no significant difference among training status and condition on power calculated from the vertical jump displacement test. The athletic group jumped significantly higher than the non-athletic group for all conditions

8.5, P = 0.01). The athletes jumped significantly higher (30.6%) than the non-athletic group across all conditions (P < 0.05). There was no significant difference among conditions regardless of training status (P > 0.05, Figure 1). There was no significant difference in average power, as calculated from the VJD test, among the condition and training status (F = 1.03, P = 0.29). However, there was a significant difference in average power generated between athletes and non-athletes (F = 6.61, P = 0.02). The athletes generated 27.7% more power than the non-athletes regardless of condition. No significant difference was found between the control and brace (P = 0.24), control and tape (P = 0.10), or the brace and tape (P = 0.79) conditions for all subjects.

No significant difference was yielded in IA time among the training status and conditions (F = 1.05, P = 0.36). There was a significant difference in IA time among athletes and non-athletes (F = 14.76, P = 0.001). The athletes completed the IA test 21% faster than the non-athletes. No difference was found in IA time between the control and brace (P = 0.32), the control and tape (P = 0.43), or the brace and tape conditions (P = 0.77).

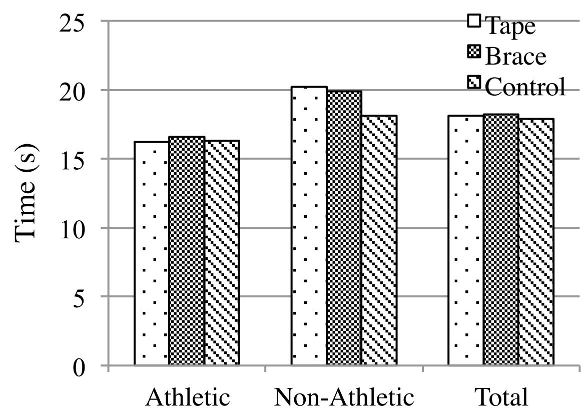


**Figure 3.** No significant difference was among training status and condition. There was a statistical difference among the groups, as the athletes completed the Illinois Agility test 21% faster. No difference was found among the conditions.

## DISCUSSION

The results of the present study yielded no significant differences in performance among the ankle conditions examined. Further, the athletic sample jumped significantly higher, completed the agility test faster, and produced more anaerobic power from the VJD test as compared to the non-athletic sample. These findings were consistent with the studies of Abián-Vicén et al. (2008), Bocchinfuso et al. (1994), and Paris (1992), who reported no performance differences utilizing various ankle taping and/or bracing treatments. These results suggest neither a standard lace-up brace or closed-basket weave taping application impeded one's (athletic or non-athletic) ability to perform.

Previously, Quackerbush et al. (2008) reported no significant differences in vertical jump performance in female athletes comparing two different ankle taping techniques to a control condition (i.e., no tape). Their findings suggest maximum force production was not reduced when the ankles were taped (Quackerbush et al. 2008). However, isokinetic ankle strength, total work, and ROM were significantly decreased when wearing ankle braces (Gehlsen et al. 1991). While ankle taping may not influence force production, Cordova et al. (2010) reported increased impact forces to the lower extremity when the ankle was taped or braced when landing from a jump. Further, significant differences were noted in the ankle and knee joint ROM in the sagittal plane when the ankles were taped and braced (Cordova et al. 2010). Despite these findings, the results of the present study reported no differences in performance on anaerobic tests in an athletic or non-athletic sample.

Paris et al. (1992) reported no significant differences in speed, balance, and agility in male soccer players. These findings were supported by Beriau et al. (1994), as they also showed there was not a significant difference in agility course performance among a control and three different ankle brace conditions. These results support the findings of this study suggesting agility was not influenced by ankle taping and bracing among an athletic and non-athletic sample.

It is important to note there are different ankle taping and bracing techniques available. The present study utilized a standard lace-up brace and a closed-basket weave taping application. These applications are thought to mimic one another in the manner in which they limit ROM. However, there are some ankle braces that limit ROM in the frontal plane, but permit full movement within the sagittal plane (Verbrugge 1996). Functional performance may be influenced depending on which method is employed.

The results of the present study may be limited by the smaller size of both the athletic and non-athletic samples. The gym floor where the agility test was performed had not been waxed recently. This caused the participants to slide during the test, which may have impacted the effort given by the subjects.

The findings of the present study suggest an athletic or non-athletic individual should be able to support the ankle via taping or bracing without significantly altering their vertical jump, agility, or power output. Future studies should focus on analyzing force production and lower extremity joint changes during sport specific tasks. Additional research should investigate performance over time as well as following prolonged activities, such as sporting events.

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