*Original Research*

# Ankle Spatting Compared to Bracing or Taping during Maximal-Effort Sprint Drills

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ABSTRACT

*Int J Exerc Sci 4(1): 49-64, 2011.* The purpose of this study was to compare the influences of 4 ankle conditions (no support, bracing, taping, taping + spatting; all in football cleats) during 2 maximal-effort field drills (40-yd dash and 34-yd cutting drill) on perceptions of comfort and stability and performance outcomes. Fourteen young adult males participated. Subjects' perceptions of comfort and stability were assessed by visual analogue scales after each drill for each ankle condition. Time-to-completion and post-completion heart rate were recorded. For both drills, significant differences in comfort perception were found such that subjects perceived no support as equivocal to bracing but more comfortable than either taping or spatting + taping. Stability results differed by drill. For the dash, significant differences in stability perception were found such that subjects perceived no support as equivocal to bracing but less stable than either taping or spatting + taping. By contrast, for the cutting drill significant differences in stability perception were found such that subjects perceived their ankles as less stable during the no support condition as compared to all 3 other conditions. Generally, bracing was perceived as equivocal to all 3 other conditions for comfort and stability. There were no significant differences in time-to-completion or heart rate for any comparison. Compared to bracing or taping, spatting + taping (a) did not influence performance time in explosive/sprint-type drills, (b) was perceived as equivalent to taping alone in terms of ankle comfort and stability, and (c) was perceived as equivalent to bracing in terms of stability but not comfort.

KEY WORDS: ankle brace, ankle tape, athletic training, football, prophylactic, tape job

## INTRODUCTION

Ankle protection measures such as bracing, taping, and spatting (where an additional layer of athletic tape is applied over the cleat and sock) are all believed to reduce ankle injury by limiting range-of-motion (ROM) (1). Researchers are currently trying to determine if there are differences in prophylactic benefits or performance effects for one technique compared to others [reviewed in (14)]. Current data has focused on comparisons of traditional ankle taping to ankle bracing and most have reported equivocal results in terms of prophylactic benefits (most often in the context of ankle sprains) and performance outcomes (6, 7, 17), though these results may be contingent on the rigidity of the specific ankle brace used. Given these findings, athletic trainers are naturally weighing benefits and drawbacks to different ankle support options. For example, one recent study in high school football athletes found that taping and bracing were equivocal in terms of ankle sprain prevention, yet bracing was financially and logistically much more pragmatic (9).

As the authors can personally attest, ankle spatting is becoming increasingly popular among college American football players and is often performed in conjunction with standard ankle taping (closed basket weave taping technique on top of quick-drying tape adherent and pre-wrap applied against the skin), giving the players' ankles 2 total layers of tape. Athletes sometimes request spatting because they perceive their ankles as being more supported (and hence better protected from injuries) compared to taping alone. Athletic trainers may be reluctant to routinely spat ankles due to the time, energy, and costs involved.

Much less research exists regarding spatting in comparison to standard taping or bracing. Spatting has been shown to reduce translational and rotational forces on the heel during cleat contact with playing surface in a mechanical model (5). A retrospective study of anterior cruciate ligament injuries in National Football League players found that spatting did not lessen the risk of ACL injuries (16); although it is likely that the authors implied spatting was done in conjunction with taping, this was not specified. To the best of our knowledge, only three experimental studies on ankle spatting have been conducted which varied in modes of exercise and taping protocols. In one study of 17 young men, ankle spatting was more effective than taping at reducing ankle inversion and plantar flexion during 60 minutes of playing non-tackle American football (19); in that study, taping and spatting were tested only as separate conditions (e.g., there was no taping + spatting condition). Though subjects reported no differences in perception of movement-restriction or stability between the 2 conditions in Likert scales, they did perceive ankle taping as more comfortable than spatting (19). Another study exposed 15 young adult male rugby players to sudden ankle inversions (via platform drop) before and after 30 minutes of rugby drills in 4 ankle conditions (taped, spatted, and taped + spatted as compared to untaped). The researchers found that spatting + taping was more effective than either of the other 2 conditions in reducing both amount and rate of ankle inversion both before and after exercise (12). Using the same 4 ankle conditions, a different study of 10 male college athletes asked to execute 3 trials each of a 40-yard sprint or 40-yd cone drill found no differences in performance times or post-exercise eversion, inversion, or plantarflexion ROM between conditions (18). Neither the second nor third studies examined athletes' perceptions of spatting compared to other conditions, nor was it reported in any of the studies whether subjects wore the same model of cleat and sock (which may be an unaccounted variable in terms of proprioception).

The purpose of the present investigation was to expand upon these previous findings by examining perceptions of comfort and stability as well as performance outcomes in young adult males under 4 ankle conditions (braced, taped, taped + spatted, and no support [control]). We employed an exercise model similar to that of (18) consisting of 2 field drills (a dash and a cone-based cutting drill) for each ankle condition, but used a hybrid intervention design incorporating both bracing and taping techniques and asked our subjects to give a *single, maximal effort* for each drill under each condition. Unlike all previous studies reviewed, we assessed perceptions of comfort and stability after each drill/ankle condition using visual analogue scales (VAS) rather than Likert scales because VAS has recently been validated as a more reliable tool (10). Heart rate and performance times for both drills, as well as bad contacts or misses on the cutting drill, were compared across ankle conditions. Also unlike all previous studies reviewed, we implemented additional levels of control in the cleats, socks, and braces worn. We hypothesized that (a) there would be no performance differences between the four ankle conditions and (b) the no support condition would be perceived as most comfortable but least stable compared to all other conditions, and the taping + spatting conditions would be perceived as least comfortable but most stable compared to all other conditions.

## METHOD

### *Human Subjects*

All procedures were approved by the Drake University Institutional Review Board prior to recruitment (Drake IRB ID 2009-10031). Fourteen active young adult males participated in the study after signing informed consent (age 25.7 ± 4.2 yr; height 184.5 ± 5.6 cm; mass 74.7 ± 9.6 kg; body fat percentage 11.3 ± 3.4% as assessed by bioelectrical impedance analysis with Bodystat 1500 [Bodystat Ltd.]). [Anthropometrically the subjects would be most analogous to defensive backs or wide receivers in American football.] Subjects reported no meaningful injuries of the ankle or foot in the preceding 3 years. None of our subjects were current college football players but all reported some form of training for at least 4 hours/week at the time of the study. Eleven of the subjects reported never being taped previously; for the 3 subjects who had experienced ankle taping, the most recent experience was over 2 years prior; hence, our subject pool was generally unfamiliar with the ankle support measures employed. We did not ask subjects about previous football experience.

### *Ankle Support Procedures*

Four ankle conditions were tested in this study: no ankle support (control), bracing alone, taping alone, or spatting + taping. The order of trials was balanced such that each condition occurred with equal frequency in every order position and semi-randomized such that the taping and taping + spatting trials occurred contiguously (to reduce possible variation from multiple taping procedures within the same subject).

Subjects completed all drills in the same football cleat model (Adidas Corner Blitz 8; Adidas Inc.). Subjects whose running shoes were size 10.5-11.5 were fitted in a size 11 cleat (n=11) and subjects whose running shoes were size 12-13 were fitted in a size 13 cleat (n=3). Each subject was given a brand new pair of identical socks (Adidas Climalite cushioned comfort, calf-length, size large; Adidas Inc.) prior to testing which they wore for all 4 conditions. All ankle preparation procedures were conducted on the sidelines near the exercise site and subjects only wore the cleats and socks when their ankles were being prepped or when on the field.

Standard ankle taping technique for American football players was employed as described immediately below. The same researcher (GDR) completed all taping and bracing and was not a certified ATC but conducted his work under the supervision of a certified athletic trainer (ARD). Before taping, the skin was prepared by aerosolized adhesive (Tuf-Skin Tape Adherent; Cramer Products Inc.), heel and lace pads (3×3-in cushioned heel and lace pads and Skin-Lube lubricating ointment; both Cramer Products Inc.), and a single layer of underwrap (2 ¾″ pretaping underwrap; Mueller Sports Medicine Inc.). Standard ½″ white athletic tape (Johnson & Johnson Consumer Companies, Inc.) was used for taping and spatting and was overlapped by half-width. For the taping procedure (Figure 1), 3 anchor strips were applied to both the proximal and distal ends followed by 2 medial stirrup strips alternating with additional anchor strips. Closing strips were then used to cover all exposed underwrap. Next, 2 each alternating medial and lateral heel locks followed by 2 medial figure-8's were applied. Finishing strips were then applied starting at the proximal anchor strips and ending at the distal anchor strips. In this protocol, ankle taping was sometimes performed by itself and other times in conjunction with spatting; however, spatting was always performed in tandem with taping. For the spatting procedure (Figure 2), subjects first had their ankles taped as described above, then donned a sock and cleat before spatting. The taping technique for spatting replicated the same order of operations as used for standard ankle taping with slight modification to avoid covering any spikes. Due to the additional ankle circumference generated by the sock and cleat being over the ankle, a greater number of closing and finishing strips were necessitated.

Figure 1. Ankle Taping Procedure.

Figure 2. Ankle Spatting Procedure.

standard lace-up ankle brace (199RB light weight ankle brace, McDavid Knee Guard Inc.) worn over the sock was used for the bracing procedure with all eyelets threaded. Subjects that wore a size 11 cleat used a size medium brace whereas subjects that wore a size 13 cleat used a size large brace. To ensure the braces were consistently taut between subjects, subjects were allowed to thread the laces but the same researcher (GDR) tightened and tied all brace laces.

Goniometry was performed on the right ankles of a subset of subjects (n=5) to determine how each ankle support measure modified ankle ROM using 4 tests: dorsiflexion, plantarflexion, talar eversion, and talar inversion. A standard, plastic 12" goniometer capable of 360° movement (HPMS, Inc.) was used for measurements. All measurements were taken at rest.

*Exercise Protocol & Measured Outcomes*

All drills were conducted on an artificial turf ("Field Turf", 2nd generation; Tarkett Sports Co.) at the Drake University Football Stadium and all experimental sessions occurred on dry turf. Subjects were allowed an unstructured 5-minute warm-up period prior to their first trial during which time most subjects jogged lightly and stretched. Two drills were performed: a 40-yard dash and a 34-yard cutting drill. Each subject performed both drills in all 4 ankle conditions only once because they were instructed to give *maximal effort* each time and we wanted to avoid both physical and psychological fatigue. Heart rate was recorded before and after each exercise using a heart rate monitor (F6 model; Polar Electro Oy); to ensure consistency between all drills, subject heart rates had to be within 10 beats per minute of baseline (as determined when standing on the field) before initiating movement. For the 40-yd dash, subjects started on the goal line and ran out to the 40-yd field line. Time was recorded via stopwatch. For the cutting drill (Figure 3), 6 orange disc cones (Adidas Inc.) were staggered on the field such that 2 lines of 3 cones were formed, with the space between cones being 5 m and the space between cone lines also being 5 m; however, the lines were offset by 2.5 m relative to each other. The start point was 5 m to the side and 2.5 m away from the first cone, in line with the contralateral cone line. The total running distance from start to the last cone was 34 yards. Subjects were instructed to "cut" to each cone as fast as possible and to touch left-side cones with the left foot and right-side cones with the right foot. Time (from start to last cone) was recorded via stopwatch and both bad contacts (such as contacting a right-side cone with a left foot) and missed contacts (not touching the cone) were tabulated. Subjects were not allowed to see any performance measures until the completion of the experiment.

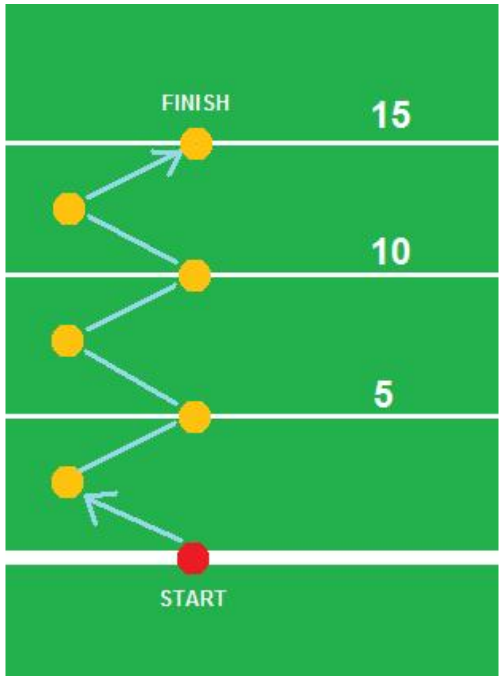


Figure 3. Depiction of the cutting drill. The red dot indicates the where the athlete would stand on the goal line to start. The light blue line indicates the path ran by the athlete. Hash marks are given on each field line to indicate field position. The total distance traversed was 34 yards from start to finish.

Subjects were asked to rate their perceptions of ankle comfort and stability separately after each drill/ankle condition combination using a 150-mm visual analogue scale. In this procedure, subjects were presented with a solid line with 2 anchor terms on both ends and asked to make a mark on the continuum indicating their perception. Subjects were presented with blank scales each time so they could not see previous responses; additionally, only one scale was presented per sheet. The comfort scale was anchored with the terms "very uncomfortable" on the left and "very comfortable" on the right; similarly, the stability scale was anchored with "very unstable" on the left and "very stable" on the right. Measurements were taken from the left anchor out to the subjects' marks. Previous research has indicated that a difference of 9.6-10.2 mm is indicative of a clinically-relevant finding (10).

*Statistics*

Univariate ANOVAs were conducted in PASW 18.0 (SPSS, Inc.) with an $\alpha$ level of 0.05 for significance. When significance was detected, post-hoc tests (LSD) were conducted. Data from the dash and cutting drills were analyzed separately. Ankle condition and trial order served as between-subjects factors and the following outcomes served as dependent factors in 8 separate analyses: dash-time, dash-comfort, dash-stability, cutting-time, cutting-comfort, cutting-stability, cutting-bad contacts, cutting-misses. Ankle condition and pre/post exercise time points served as between-subjects factors and heart rate served as the dependent factor in the 2 heart rate analyses (for the dash and cutting drills separately).

**RESULTS**

Subjects' perceptions of comfort and stability for both drills are presented in Table 1. For comfort ratings in both drills, there was a main effect of ankle condition (p=0.046 and 0.027, respectively). Follow-up post-hoc tests revealed that the no support condition was perceived as more comfortable compared to taping or spatting + taping in both drills (all p≤0.021). Bracing was perceived as equivocally comfortable to all 3 other conditions in both drills. There were no significant differences for other comparisons. There was no trial order effect.

Table 1. Subjects' perceptions of comfort and stability for all 4 ankle conditions in both drills, as assessed by visual analogue scales. Values are averages in cm ± standard error, and asterisks (*) denote statistically significant differences compared to no support (baseline control). Higher values indicate greater comfort and stability, respectively. See methods for a more detailed description of the scales.

| Drill | Ankle Condition | Comfort | Stability |
|---|---|---|---|
| Dash | No Support | 10.3 ± 1.1 | 8.3 ± 0.8 |
| | Braced | 8.8 ± 1.2 | 10.1 ± 0.8 |
| | Taped | 6.2 ± 1.2* | 11.7 ± 0.9* |
| | Spatted + Taped | 6.3 ± 1.1* | 12.1 ± 0.8* |
| Cutting | No Support | 9.9 ± 1.0 | 7.2 ± 0.8 |
| | Braced | 8.7 ± 1.1 | 9.9 ± 0.9* |
| | Taped | 5.9 ± 1.1* | 11.7 ± 0.9* |
| | Spatted + Taped | 6.3 ± 1.0* | 11.9 ± 0.8* |

For stability ratings in both drills (Table 1), there was a main effect of ankle condition (p=0.001 and 0.006, respectively). However, significant pairwise comparisons for stability as revealed by posthoc tests differed by drill. For stability perception in the dash, subjects perceived the no support condition as being less stable than either taping or spatting + taping (both p≤0.006); bracing was perceived as equivocally stable to all 3 other conditions. For stability perception in the cutting drill, the no support condition was perceived as being less stable than all 3 other conditions (all p≤0.028), whereas the other conditions were perceived as being equivocally stable. There were no significant differences for other stability comparisons for either dash or cutting drill. There was no trial order effect.

Heart rate and performance times are displayed in Table 2. Subjects' resting (sitting) heart rates were 66.9 ± 9.0 beats per minute (bpm); however, their standing resting heart rates on the field were 95.6 ± 2.3 bpm and consequently the latter was used for pre-exercise heart rate values (baseline). Although heart rate always expectedly and significantly increased from pre- to post-exercise, there were no differences in absolute heart rates between ankle conditions in either exercise. Additionally, the change in heart rate (post minus pre) was not significantly different between ankle conditions in either exercise. Individual subjects' changes in heart rate are graphed in Figure 4.

Table 2. Performance outcomes (heart rate and time) for both drills. Heart rate data is expressed as average beats per minute ± standard error. Asteriks indicate a significant difference in heart rate from pre- to post-exercise. Performance time is expressed as average seconds ± standard error. Within respective tests, no comparisons were statistically significantly different.

| **Drill** | **Ankle Condition** | **Heart Rate (bpm)** | | **Performance Time (sec)** |
|---|---|---|---|---|
| | | **Pre-Ex** | **Post-Ex** | |
| Dash | No Support | 95.9 ± 5.3 | 149.1 ± 4.3* | 5.5 ± 0.1 |
| | Braced | 94.2 ± 5.2 | 144.4 ± 4.1* | 5.6 ± 0.1 |
| | Taped | 96.4 ± 4.8 | 145.7 ± 4.1* | 5.7 ± 0.1 |
| | Spatted + Taped | 93.0 ± 4.3 | 141.4 ± 3.8* | 5.7 ± 0.1 |
| Cutting | No Support | 96.9 ± 5.2 | 148.9 ± 4.0* | 8.7 ± 0.2 |
| | Braced | 96.5 ± 5.2 | 147.5 ± 3.8* | 8.7 ± 0.2 |
| | Taped | 95.2 ± 4.6 | 147.6 ± 4.0* | 8.6 ± 0.2 |
| | Spatted + Taped | 96.4 ± 4.7 | 146.2 ± 3.4* | 8.6 ± 0.2 |

There were no significant differences in performance times between ankle conditions for either drill (Table 2). There were no effects of trial order for either drill. Bad contacts and misses were also tabulated for the cutting drill but were infrequent so there were no significant differences between ankle conditions or trial order for either. The performance of individual subjects in terms of inadvertent footsteps is displayed in Table 3. No trial order effects were uncovered for any of the performance outcomes.

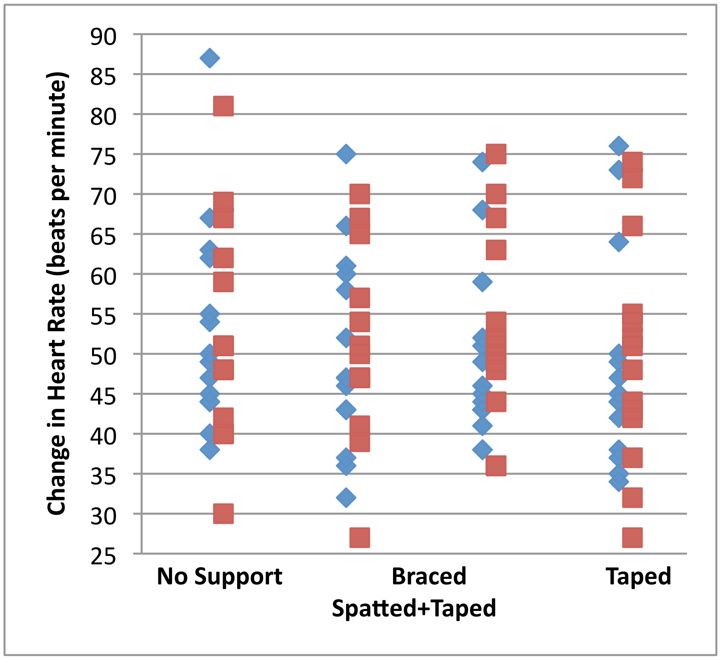


Figure 4. Changes in heart rate for each individual subject in both the 40 yard dash (blue triangles) and 34 yd cutting drill (red squares).

Table 3. Inadvertent footsteps (BC = bad contacts; M = misses) for each individual subject (numbered 1-14) in the cutting drill under all 4 ankle conditions.

| | No Support | | Braced | | Taped | | Spatted + Taped | |
|---|---|---|---|---|---|---|---|---|
| | **BC** | **M** | **BC** | **M** | **BC** | **M** | **BC** | **M** |
| **1** | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2** | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| **3** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **4** | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| **5** | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| **6** | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 2 |
| **7** | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| **8** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **9** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **10** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **11** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **12** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **13** | 0 | 2 | 0 | 3 | 0 | 1 | 0 | 2 |
| **14** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Range-of-motion of the right ankle was evaluated on a subset of subjects at rest to see what effect each ankle protection measure had in all 4 ankle conditions plus an additional control condition of just the sock without the cleat. Figure 5 illustrates the results for 4 different goniometric measurements: plantarflexion, dorsiflexion, talar eversion, and talar inversion. There was no significant difference between ROM with just the sock compared to the sock + cleat ($p=0.525$) indicating that the cleat itself did not influence ROM. However, all other conditions were significantly different from each other and from sock alone or cleat + sock. Spatting was significantly more restrictive than all other conditions (all $p \leq 0.008$), as expected. Taping was significantly less restrictive than spatting ($p=0.008$) but more restrictive than the other 3 conditions ($p \leq 0.007$). Bracing was significantly less restrictive than either taping or spatting + taping ($p \leq 0.007$) but significantly more restrictive than either sock alone or sock + cleat ($p \leq 0.002$).

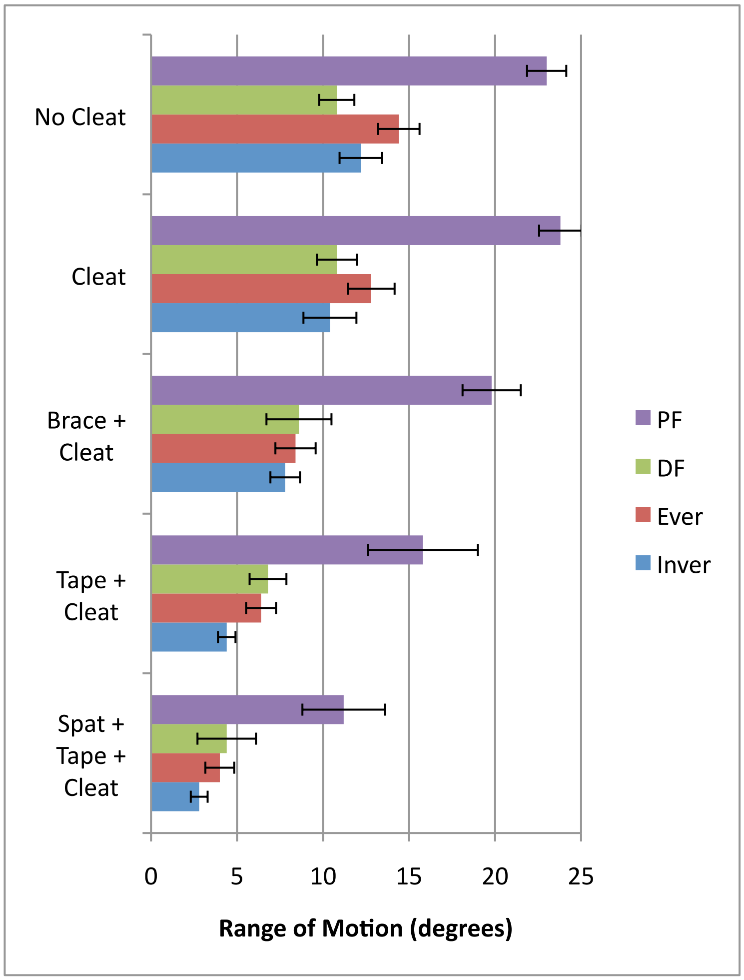


Figure 5. Ankle ROM ( expressed in degrees) as evaluated by goniometry for a subset of subjects in 5 ankle conditions: no cleat, cleat, brace + cleat, tape + cleat, and spat + tape + cleat. All tests were performed in socks. Abbreviations for tests: PF = plantarflexion; DF = dorsiflexion; Ever = eversion; Inver = inversion.

## DISCUSSION

Our first hypothesis was that there would be no performance differences (time, change in heart rate from pre- to post-exercise, cone contacts) across ankle conditions. The data presented in Tables 2 and 3 and Figure 4 confirms this hypothesis. For the single, maximal-effort sprint-type drills utilized here, spatting + taping did not result in performance differences as compared to other conditions. These results may also suggest that "breaking in" a tape job prior to competition or practice is unnecessary since our subjects exercised immediately after being taped.

Our second hypothesis was that there would be differences in perceptions of comfort and stability such that the no support condition would be perceived as most comfortable but least stable compared to all other conditions, and the spatting + taping condition would be perceived as least comfortable but most stable compared to all other conditions. The data presented in Table 1 partially supports our hypothesis but reveals greater complexity. In terms of comfort, the no support condition was perceived as equivocal to bracing but was more comfortable than either taping or spatting + taping. However, subjects did not perceive any significant differences in comfort between bracing and any other condition. Goniometry data (Figure 5) was congruent with the comfort data and suggested bracing had an intermediary effect on ankle ROM compared to other ankle conditions and that spatting + taping was the most restrictive. Considering the equivocal prophylactic benefits of bracing versus taping reviewed earlier (6, 7, 9, 17), these results together may suggest that bracing elicits an "intermediary" level of comfort as compared to either no support on one end or taping and spatting + taping on the other. Athletes who experience an acute ankle injury and are suddenly indicated for ankle prophylaxis might be less discomforted by bracing compared to taping or spatting + taping. Spatting + taping was perceived as equally comfortable to taping alone; however, it significantly restricted ROM over taping alone. Athletes who routinely get their ankles taped might not experience any additional discomfort if spatting is also applied.

The findings for stability (Table 1) were more complicated and varied by drill. First, in the dash, subjects perceived the no support condition as being less stable than either taping or spatting + taping. Bracing was perceived as equivocally stable when compared to all 3 other conditions (similar to what was found for comfort in both the dash and cutting drills). Second, in the cutting drill, subjects perceived the no support condition as being less stable than all 3 other conditions, with no differences perceived between the other 3 conditions. Taken together, the stability results suggest the no support condition was generally perceived as less stable than other options, and that no additional stability was perceived from spatting + taping compared to taping alone. These findings are somewhat discongruent with the goniometry (Figure 5) which showed spatting + taping restricted ROM the most. Considered in conjunction with the comfort data, these results may suggest that ROM restriction has a stronger effect on athletes' perceptions of comfort as compared to stability. Returning to the case of an athlete that experiences a novel ankle injury and is suddenly indicated for prophylaxis, our findings suggest that bracing may elicit the same perceptions of stability as taping or spatting + taping.

In the methods we referenced a study (10) that validated the use of visual analogue scales in assessing footwear comfort and whose authors reported that differences of 9.6-10.22 mm were necessary for clinically meaningful results. Across both measures of comfort and stability for both drills, the smallest difference that was determined as statistically significant in the posthoc tests was 26.9 mm (Table 1). This value is well in excess of the required difference and suggests our results are clinically relevant. One difference between our study and (10) is that we used a 150-mm line whereas they used a 100-mm line. Even if we multiply out their required difference range by 1.5 to account for the line-length discrepancy between the 2 studies (yielding a range of 14.4-15.3 mm) our smallest difference still falls well outside their range and in clinically-meaningful territory.

Some propose that spatting + taping may not be worth the time, effort, or money of the athletic training staff. Our results indicate that it does not influence perceptions of comfort and stability, nor performance, but that it does significantly reduce ankle ROM. It is imperative to note that our goniometry data was derived at rest and not post-exercise, so the effects of exercise on the "staying power" of the tape and spat jobs cannot be concluded. Also, we cannot state whether the reductions in ROM observed here are clinically relevant. Notably, reducing inversion is the primary purpose of tape jobs (to reduce risk of ankle sprain) and spatting + taping appears most effective in that regard.

Studies have shown that the prophylactic benefits of ankle taping decrease with increasing physical activity time as the tape stretches and ROM increases, even in as little as 15 minutes (3, 8, 13). Interestingly, other researchers that studied the effects of ankle taping on ROM before and after 3 hours of playing American football in 16 male college-aged football players found that the effects of time were heterogeneous and contingent on the joint movement tested (4). Another study using similar ankle conditions to ours and the same drills done repeatedly (18) showed no differences in ROM after exercise. Taken with our results, the last study specifically may suggest that the differences in ROM we observed at rest dissipate quickly once the athlete exercises for any substantial amount of time. Decreases in ROM associated with activity time is not likely to be a confounding factor in our study because subjects' total activity time in any tape condition was less than 15 minutes.

Logistical issues of spatting need to be considered also. Despite the ubiquity and tradition of ankle taping, especially in sports such as American football, cost-benefit analyses have indicated that bracing yields equivocal benefits to taping but is cheaper in terms of time, athletic trainer energy, and money (9, 11). Those costs are multiplied when spatting is also performed with taping. Our results support the findings of previous studies and suggest that ankle braces such as the lace-up model used here might be suitable substitutes for taping or spatting + taping.

There may also be additional benefits to spatting not encompassed in this experiment. In a recent study of patients presenting with ankle instability, clinicians asked the subjects to perform 2 physical tasks under 3 ankle conditions: no support (control), standard ankle taping, or "placebo" ankle taping using a single strip of tape applied above the lateral malleolus (15). While subjects performed the 2 tasks equivocally in all 3 conditions, their perceptions of "confidence," "reassurance," and "stability" were highest for the actual taping condition as compared to other conditions, but were also higher for the placebo condition compared to control. Although the authors could not document a definitive "placebo effect", the relationship between the increased application of tape and increased positive perceptions is clear. Similar to the effect of the doctor's touch in comforting patients (2), simply adding extra tape or the athletic trainer's extra time with the athlete may increase the athlete's confidence in their performance abilities and/or feelings of safety. It is possible that the influence of restricted ROM from spatting and taping may partially explain the results from the aforementioned studies. Such possibilities might be examined in future research.

This study has several limitations. First, this study did not investigate parameters related to ankle-associated injuries. Second, a majority of our participants were completely unaccustomed to being taped and none were playing college American football at the time of the study. Thus, they may not be representative of high school or college American football players who are routinely taped. It is possible that the results would be different if a pool of American football athletes were recruited such that they were familiar with the sensation of taping; on the other hand, these same athletes may have a bias towards a condition such as taping or bracing due to their familiarity with it which would skew perceptual results. Similarly, subjects may be unfamiliar with the sensation of football cleats generally or these cleats specifically and subjects had to participate in the study in size 11 or size 13 cleats with no intermediary sizes available. Eleven of the subjects brought in their running training shoes and the average mass was 367.3 ± 13.1 g whereas the mass of the cleats was 427.5 g and 454.4 g, respectively for sizes 11 and 13. The increased mass of the cleat plus the unfamiliar construction or fitting may have been a confounding factor in subjects' perceptions of comfort or stability. Third, we did not study spatting in isolation but only in combination with standard ankle taping. It is possible the effects of spatting might be more clear if it had been studied as a separate condition. Fourth and finally, because we asked for a single, maximal effort from all subjects, we had only one trial for each ankle/drill condition for each subject.

In conclusion, spatting + taping demonstrated no additional benefits or drawbacks in terms of performance and may be perceived as less comfortable than and equivocally stable to a standard lace-up ankle brace by athletes, yet significantly reduced ankle ROM (at least immediately after application) compared to other ankle protection measures such as taping or bracing. Reductions in ankle ROM could not be linked to any other outcomes and it is unknown whether the reductions seen here are clinically meaningful. Therefore, given its limitations this study does not provide any evidence in support of ankle spatting in athletic training for American football-associated maximal effort sprint drills.

## ACKNOWLEDGEMENTS

Thank you to all the subjects who donated their time to participate. GDR completed the research in partial fulfillment of the requirements for a bachelor's of science degree in biology. Travis Klatt helped during initial design brainstorming. Michael Ball coordinated use of the field with Athletics.

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