The Effects of the Swede-O, New Cross, and McDavid Ankle Braces and Adhesive Ankle Taping on Speed, Balance, Agility, and Vertical Jump

David L. Paris, PhD, ATC, CAT(C)

ABSTRACT: Scores from motor performance tests were compared using subjects with taped and untaped ankles. Previous studies have shown that taped ankle support may be detrimental in vertical and standing broad jumping performance. Conflicting data have been published on the effects of commercial ankle braces on various motor tasks. The performances of 18 elite soccer players in selected tests of speed, balance, agility, and vertical jumping were compared under conditions of untaped, nonelastic adhesive taped, Swede-O-braced, New Cross-braced, and McDavid-braced ankles. Vertical jump performance was significantly reduced when subjects wore New Cross braces. There were no significant differences in tests of speed, balance, and agility among any of the support conditions. Until now, nonelastic adhesive tape has been the preferred method of prophylactic ankle support. I conclude that certain commercial ankle braces may be used as a support alternative during selected activities.

For many years it has been common practice for athletic trainers to use prophylactic ankle tape. Many studies have evaluated the effectiveness of tape under various experimental conditions, but the results have not produced a concensus of opinion. Several researchers have shown that tape loses much of its supportive quality after exercise (3,6,8,17,21,23,27), while others have demonstrated significant support retention (9,15,16,20,29).

Numerous studies (1,5,14,19,22,28, 30) have compared the effects of ankle strapping conditions (eg, untaped, nonelastic taped, elastic taped, combination elastic-nonelastic taped, Louisana wrapped) on various motor performance tasks. No significant differences were found in performances of speed (22,28), balance (14,22), agility (19,22,28,30), and vertical and long jumping (22,30) among any of the experimental treatments in these studies. Some researchers have stated that ankle taping did not significantly affect the ankle plantar flexion torque production (1,5,7); however, earlier authors reported that ankle taping significantly decreased vertical (13,18) and standing broad jumping ability (19).

Several comparisons of commercial or experimentally-adapted ankle braces to nonelastic adhesive tape under various experimental conditions have produced confounding results (3,9-11,21,25). One study in which ankle stabilizers of varying stiffnesses were fitted directly into shoes showed decreased performance over an obstacle course (measured by time) as ankle and subtalar movement restriction increased (24). Another study using a laboratory instrument to apply inversion torque to a polyurethane foot form to which the respective supportive devices were attached, found that after 20 minutes of movement, the two most restrictive braces lost 4.5% and 8.5% of ankle support, compared to a 21% loss of support with adhesive-taped ankles (3). Tape provided a 25% greater pretest inversion range of motion restriction than any of the braces, but, after movement, there was no difference in residual support among the two most effective braces and tape (3).

A more recent study showed that the Swede-O brace limited passive plantarflexion range of motion significantly more than any other device when tested after 4 minutes of jogging and walking (7). Also, the Swede-O brace and the tape significantly restricted passive dorsiflexion range of motion when compared to two other braces and unsupported ankles (7). Conversely, a passive measure of ankle ranges of motion pre- and post-activity showed no significant ankle or subtalar joint support from either tape (zinc oxide and elastic) or elastic ankle guards (Ace and Futuro) after 1 hour of playing squash (21).

Significantly slower base running times during softball practice were reported while wearing one particular ankle brace as compared to another (8). Others concluded that both tape and ankle guards were effective in retaining ankle immobilization and that neither affected lower extremity functioning while running (10).

The purpose of this study was to determine if differences exist in selected tests of speed, balance, agility, and vertical jump when performed while using a variety of experimental conditions, eg, untaped (control), nonelastic taped, and braced ankles.

Methodology

Twenty-five male soccer players, who had been identified through the Canadian National and Quebec Provincial Soccer Associations as elite players, were randomly selected from a pool of approximately 75 players from the Montreal Regional High Performance Centre. Although some players' ankles had been injured previously, no residual effects were prevalent at study time as confirmed by the attending

David Paris is associate professor and sports medicine coordinator in the Department of Exercise Science at Concordia University in Montreal, Quebec, Canada.

athletic trainer. During the study, seven players withdrew because of injuries incurred while training with their club teams or for personal reasons. The remaining 18 players (age = 17.6 ± 1.7 yr, ht = 69.4 ± 4.4 in, wt = 155.2 ± 9.8 lb) served as subjects. All subjects had experienced having their ankles taped, and 2 weeks prior to the study they were given the ankle braces to wear and become accustomed to.

The four selected performance tests as described by Johnson and Nelson (12) were: (1) the 50-yard sprint, (2) the Nelson Test of static and dynamic balance, (3) the SEMO Agility Test, and (4) the Sargent Chalk Jump Test. All tests were administered at an indoor athletic complex on a synthetic surface. Testers remained at the same stations throughout the study in order to control the effects of individual variances in data recording.

Speed over a distance of 50 yards from a standing start was recorded to the nearest .01 second with a hand-held stopwatch. The Nelson Test, used to measure both static and dynamic balance, consisted of a series of stepping blocks, upon which the subject was asked to maintain one-footed balance for 5 seconds, and a 12-foot balance beam, situated 7 inches above the floor and over which the subject had to cross both in a heel-to-toe fashion and by sidestepping.

The SEMO Agility Test, which incorporates lateral, backward, and forward running, was used to measure agility performance to the nearest 0.1 second. The Sargent Chalk Jump Test measured the distance between the subject's highest reach on a wall from a standing position and the wall mark made at the highest point of the jump. Measurement difference to the nearest ¼ inch was calculated as the vertical jump data.

Each subject was tested on speed, balance, agility, and vertical jump in random order. All tests were performed under each of the five ankle support conditions. The order in which the supports were worn was determined by random selection also. The subjects completed the battery of activities under one ankle condition only on the first day. A period of 7 days preceded each subsequent testing session for each of the four remaining experimental conditions. The athletic trainer supervised a 10-minute warm-up of jogging and stretching prior to each day's testing.

Under the control condition, each subject performed the four tests without his ankles being taped or braced. For the taped condition, the subjects shaved their ankles to 6 inches above the malleoli, and a coating of tape adherent then was sprayed on the skin to minimize slippage. Antifriction heel and lace pads with skin lubricant and underwrap then were applied prior to the nonelastic adhesive athletic tape. A modification of the Gibney closed basketweave as shown by Arnheim (2) was used. Proximal and distal anchor strips were attached to the underwrap, but were allowed to overlap directly onto the shaved skin to prevent slippage. Two extra strips of tape (half stirrups) were added to afford the rear foot more support in valgus (calcaneal eversion). All ankles were taped bilaterally by the same athletic trainer to control the effects of individual variations.

Braces used were the McDavid A101 ankle brace (McDavid Knee Guard, Inc, Claredon Hills, Ill), New Cross #120 ankle brace (New Cross International Limited, Scarborough, Ontario, Canada), and Swede-O ankle brace (Swede-O-Universal, North Branch, Minn) (Fig 1). Subjects put on the braces and tightened them according to the instructions of the athletic trainer.

Each motor performance test was analyzed with the SAS statistical package General Linear Model (GLM) one-way analysis of variance with repeated measures (26). Five planned posthoc comparisons (Scheffé tests) were used to identify the location of significant differences among the group means.

Results

There were no significant differences among conditions in the results of speed ($F(1,4)=.71, p=.59$), balance ($F(1,4)=.52, p=.73$), and agility ($F(1,4)=.61, p=.66$). However, there were differences found between vertical jump conditions ($F(1,4)=3.99, p=.01$); New Cross-braced ankles showed less difference than untaped ankles (Scheffé $p=.054$). It is imperative to note a similar, yet insignificant difference in vertical jump performance between untaped ankles and McDavid-braced ankles ($p=.49$) (Table 1).

Discussion

Although slower times with ankle braces have been recorded while base running during softball practice (8), the present data support the findings of other studies that reported no significant differences in speed, balance, and agility when ankles were taped (14,19,22,28,30). As there were no significant differences in performance tests of speed, balance, and agility in this study—with any ankle support devices or with unsupported ankles—it would be wrong to conclude that braces and tape are either helpful or detrimental in these performance settings. Therefore, the amount of support offered by an ankle brace in these activities may be the determining factor of choice.

Over a six-year period, Rovere et al (25) tabulated ankle injuries of athletes with taped and braced ankles while wearing combinations of high-top and low-top

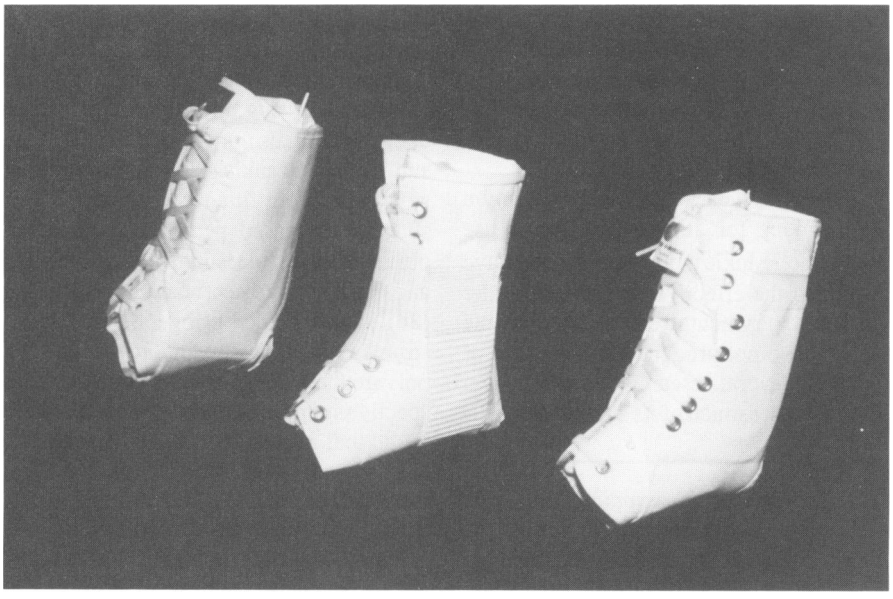

Fig 1.—McDavid (left), New Cross (center), and Swede-O ankle braces

Table 1.—Results of Athletic Performance Tests (N=18; Mean and Standard Deviation)

	Untaped	Taped	Swede-O Brace	New Cross Brace	McDavid Brace
Speed (sec)	6.60 ± 0.31	6.59 ± 0.28	6.62 ± 0.29	6.70 ± 0.30	6.66 ± 0.36
Balance (sec)	74.49 ± 7.45	76.82 ± 8.50	76.39 ± 9.30	74.24 ± 7.73	76.04 ± 9.60
Agility (sec)	11.69 ± 0.84	11.53 ±0.68	11.47 ± 0.53	11.64 ± 0.71	11.61 ± 0.49
Jump (in)	23.50 ± 2.29	22.94 ± 1.84	22.60 ± 2.38	22.22 ± 2.34*	22.36 ± 2.02

* Significantly different ($p > .05$) from untaped condition (control)

shoes. They reported that, overall, fewer injuries occurred while wearing low-top shoes in combination with lace-up ankle braces.

The present study revealed a significant decrease (5.4%) in vertical jump performance between untaped and New Cross-braced ankles. A decrease in this activity, although insignificant, also was noted among untaped and McDavid-braced (4.9%), Swede-O-braced (3.8%), and taped (2.4%) ankles. Burks et al (4) also reported decreased performances (3.4% to 4.6%) in the vertical jump while wearing tape, or either of two types of ankle braces (Swede-O and Kallassy) when compared to unsupported ankles. Similar percentage decreases in the standing broad jump performances were observed with the Swede-O brace and in the shuttle run with the Kallassy brace (4). Further, two older studies on jump performance yielded decreased vertical (13,18) and standing broad jump (18) scores with taped ankles compared to untaped ankles. It also is interesting to note that Gehlsen et al (7) recorded significantly lower plantarflexion torque at slow and moderate speeds with taped and braced ankles when compared to unsupported ankles.

Is the small percentage decrease in athletic performance when wearing ankle prophylactic devices warranted in order to achieve increased ankle joint protection (4)? Table 1 shows the mean differences in vertical jumping among two of the braces (Swede-O and McDavid) and the untaped ankles as 0.9 and 1.14 inches respectively. These differences were statistically insignificant. However, the argument for the need to maintain maximal performance capabilities may be supported by the examples of the soccer goalie who needs the extra measure to fingertip a shot over the crossbar, or a basketball player faced with a tipoff. However, ankle injuries are the most frequent injuries occurring in sports (2), and, from the athletic trainer's point of view, all preventive measures must be taken.

The findings of this study suggest that some commercial ankle braces may be used as ankle support alternatives to tape in selected activities. However, future research on ankle prophylaxes should focus on their effects on vertical jump performance over extended activity periods. The residual support that braces provide during and after prolonged activities also should be investigated.

Subjects' performances in speed, balance, and agility were not significantly affected by wearing tape or braces when compared to wearing no ankle support. Similarly, no significant differences in vertical jump performance were found between taped and braced ankles. Therefore, budgetary considerations may be the critical factor when selecting certain ankle braces to replace nonelastic adhesive tape.

Many teams have limited budgets for medical supplies. This concern was important as early as the mid-1970s (19). Other researchers (11,25) have noted the cost-effectiveness of using braces instead of tape. Table 2 represents the expenditure when purchasing tape and braces for the 25-week season of a college basketball team. The players would be active 6 out of 7 days per week, including games and practices.

With a top quality 1½-inch zinc oxide athletic tape at an approximate cost of $2.00 (Canadian) per roll, an average of two thirds of a roll would be used to tape one ankle in the modified Gibney closed basketweave. With adjunct supplies such as tape adherent, underwrap, heel and lace pads, and skin lubricant, the total cost of taping one ankle was projected at $1.45 (Canadian). When braces are substituted for tape, a net saving of 63.2% can be made during a basketball season.

Table 2. —Tape and Ankle Brace Cost Comparisons During a 25-week Basketball Season (prices in Canadian Funds)

A.	Tape cost per player Participation: 6 days/week 150 days total participation x 2 ankles = 300 protected ankles/season 300 ankles @ $1.45	=	$435.00
B.	Brace cost per player 4 braces/season (Based on two pairs per season) 4 braces @ $40.00	=	$160.00
C.	Savings (A - B) / per player	=	$275.00 (63.2%)
	12 - player roster savings	=	$3300.00

Savings can also be estimated for a soccer player who plays and practices three times per week (61.6%) for an all year (48 week) indoor-outdoor season, and for a football player active 6 days per week during a 10-week season (54.0%). The latter would purchase one pair of braces for a short season. The soccer player's costs for braces would be liberal as the figures are based on the purchase of two pairs of braces per year. If only one pair was used for a complete season, the savings would increase for both soccer (80.8%) and basketball (81.6%), with the latter team budget savings for a 12-man roster increasing from $3300 to $4260.

I conclude that some commercial ankle braces may be used as an alternative to adhesive tape, and that athletic trainers might want to consider them in light of potential savings.

Acknowledgements

This research was supported by grants from Fonds Pour La Formation De Chercheurs Et l'Aide A La Recherche (FCAR); La Regie de la Securite dans les Sports du Quebec, St. Foy, Quebec, Canada; and the Faculty of Arts and Science General Research Fund, Concordia University, Montreal, Quebec, Canada. The author thanks McDavid Knee Guard Inc, Clarendon Hills, Ill; New Cross International Ltd, Scarborough, Ontario, Canada; and Swede-O-International, North Branch, Minn, for providing the ankle braces used in the study.

References

1. Abdenour TE, Saville WA, White RC, Abdenour MA. The effect of ankle taping upon torque and range of motion. *Athletic Training, JNATA.* 1979;14:227-228.
2. Arnheim DD. *Modern Principles of Athletic Training.* 7th ed. St. Louis, Mo: Times Mirror/Mosby College Publishing; 1989:324-325.
3. Bunch RP, Bednarski K, Holland D, Macinanti R. Ankle joint support: a comparison of reusable lace-on braces with taping and wrapping. *Phys Sportsmed.* May 1985;13:59-62.
4. Burks RT, Bean WG, Marcus R, Barker HB. Analysis of athletic performance with prophylactic ankle devices. *Am J Sports Med.* Mar/Apr 1991;19:104-106.
5. Fischer RD. The measured effect of taping, joint range of motion, and their interaction upon the production of isometric ankle torques. *Athletic Training, JNATA.* 1982;17:218-233.
6. Fumich RM, Ellison AE, Guerin GJ, Grace PD. The measured effect of taping on combined foot and ankle motion before and after exercise. *Am J Sports Med.* May/June 1981;9:165-170.
7. Gehlsen GM, Pearson D, Bahamonde R. Ankle joint strength, total work, and ROM: comparison between prophylactic devices. *Athletic Training, JNATA.* 1991;26:62-65.
8. Greene TA, Wight CR. A comparative support evaluation of three ankle orthoses before, during and after exercise. *J Orthop Sports Phys Ther.* April 1990;11:453-466.
9. Gross MT, Bradshaw MK, Ventry LC, Weller KH. Comparison of support provided by ankle taping and semirigid orthosis. *J Orthop Sports Phys Ther.* July 1987;9:33-39.
10. Hamill J, Knutzen KM, Bates BT, Kirkpatrick G. Evaluation of two ankle appliances using ground reaction force data. *J Orthop Sports Phys Ther.* March 1986;7:244-249.
11. Hughes LY, Stetts DM. A comparison of ankle taping and a semirigid support. *Phys Sportsmed.* April 1983;11:99-103.
12. Johnson BL, Nelson JL. *Practical Measurements for Evaluation in Physical Education.* 2nd ed. Minneapolis, Minn: Burgess Publishing Company;1986:167-168, 191-192, 212-214, 222.
13. Juvenal JP. The effects of ankle taping on vertical jumping ability. *Athletic Training, JNATA.* 1972;9:146-149.
14. Kozar W. Effects of ankle taping upon dynamic balance. *Athletic Training, JNATA.* 1974;9:11-13.
15. Laughman RK, Carr TA, Chao EY, Youdas JW, Sim FH. The dimensional kinematics of the taped ankle before and after exercise. *Am J Sports Med.* Nov/Dec 1980;8:425-431.
16. McIntyre DR, Smith MA, Denniston NL. The effectiveness of strapping techniques during prolonged dynamic exercises. *Athletic Training, JNATA.* 1983;18:52-55.
17. Malina RM, Plagenz LB, Rarick LG. Effects of exercise upon measureable supporting strength of cloth and tape ankle wraps. *ResQ.* May 1962;34:158-165.
18. Mayhew JL. Effects of ankle taping on motor performance. *Athletic Training, JNATA.* 1972;7:10-11.
19. Mayhew JL, Riner WF. Effects of ankle wrapping on motor performance. *Athletic Training, JNATA.* 1974;9:128-130.
20. Morris HH, Musnicki, W III. The effect of taping on ankle mobility following moderate exercise. *J Sports Med Phys Fitness.* 1983;23:422-426.
21. Myburgh KH, Vaughan CL, Isaacs SK. The effects of ankle guards and taping on joint motion before, during, and after a squash match. *Am J Sports Med.* Nov/Dec 1984; 12:441-446.
22. Paris DL. The effects of adhesive ankle taping and cloth ankle wrapping on speed, agility, balance, and power. *Bull Sports Med Sect Am Phys Ther Assoc.* 1978;4: 5-6, 11, 20.
23. Rarick GL, Bigley G, Karst R, Malina RM. The measureable support of the ankle joint by conventional methods of taping. *J Bone Joint Surg.* 1962;44A:1183-1190.
24. Robinson JR, Rederick EC, Copper LB. Systematic ankle stablization and the effect on performance. *Med Sci Sports Exerc.* December 1986;18:625-628.
25. Rovere GD, Clarke TJ, Yates CS, Burley K. Retrospective comparison of taping and ankle stabilizers in preventing ankle injuries. *Am J Sports Med.* May/June 1988;16:228-233.
26. *SAS/STAT User's Guide,* Release 6.03 ed. Cary, NC: SAS Institute Inc;1988.
27. Seitz CJ, Goldfuss AL. The effect of taping and exercise on passive foot inversion and ankle plantar flexion. *Athletic Training, JNATA.* 1984;19:178-182.
28. Thomas JR, Cotten DJ. Does ankle taping slow down athletes? *The First Aider.* March 1972;41:97-102.
29. Vaes P, DeBoeck H, Handelberg F, Opdecam P. Comparative radiological study of the influence of ankle joint strapping and taping on ankle stability. *J Orthop Sports Phys Ther.* November 1985;7:110-114.
30. Van Dam R, Ruhling RO. Tape composition and performance. *Athletic Training, JNATA.* 1975;10:214-216.