



## Clinician Patterns of Ankle Brace Commendation and Observation of Aspects Related with Brace Practice

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**ABSTRACT:** A group of athletic trainers and physical therapists were surveyed to determine which ankle braces they recommend most frequently to prevent ankle sprain injury, which factors associated with brace use influence decisions about ankle brace recommendation, and to determine if perceptions about factors associated with brace use are related to patterns of ankle brace recommendation. The ASO brace was the ankle brace recommended most frequently. Clinicians reported effectiveness in preventing ankle sprain injury was the most influential factor when recommending a specific ankle brace. Additionally, clinicians reported comfort of an ankle brace was the next most influential factor. Clinicians' concern about reduced ankle muscle strength after wearing an ankle brace for a period of time was related to the likelihood of whether they would recommend use of an ankle brace for patients after an ankle sprain injury.

**Keywords:** athletic trainers, physical therapists, ankle braces, ankle sprain injury,

### Introduction

Injury to the ankle joint is common among the athletic population (Garrick, 1988), military personnel (Milgrom, 1991), and the working population (Grimm, 1999). The vast majority (85%) of injuries to the foot and ankle are ankle sprains (Garrick, 1977).

Garrick (1988) reports that among injuries treated in a sports-medicine clinic over 6.5 years, twenty-five percent of the injuries occurred in the foot and ankle. Prevalence of ankle sprains in Canadian collegiate basketball players has been reported as 1.22 injuries/1,000 participations (Meeuwiss, 2003). Prevalence in recreational basketball players has been reported as high as 3.85 injuries/1,000 participations (McKay, 2001). Half of the recreational participants who incurred an ankle sprain injury missed a week or more of competition. Anderson et al. (2004) recently reported a prevalence of 4.5 injuries/1,000 match hours during competition between elite Norwegian and Icelandic soccer players. Ankle sprains also accounted for up to 41% of all volleyball injuries (Verhagen, 2004), and between 30 to 60% of all parachuting injuries in military personnel (Amoroso, 1998).

The general population also experiences an appreciable number of ankle sprains. Grimm and Fallat (1999) conducted a retrospective study of all foot and ankle injuries during a one year period at an occupational medicine clinic. They reported that 6.4% of all injuries treated at the clinic were injuries to the foot and ankle, 40.8% of which were ankle sprains. The average cost of medical treatment for all types of ankle injury for this occupational health study was \$804 per case.

### *Mechanisms of Injury*

Common mechanisms of injury for ankle sprains during sporting events include quick cutting motions, landing from a jump (McKay, 2001), landing on an uneven surface, and colliding with an opponent (Anderson, 2004). Additional mechanisms reported include missteps, stepping on objects, and inverting the ankle on uneven terrain while walking or jogging. The risk for additional ankle sprain injury increases following an initial injury (Surve, 1994; Yeung, 1994). McKay (2001) reported basketball players with a history of ankle sprain are up to five times more likely to suffer a recurrent sprain than individuals without previous injury.

### *Preventing Ankle Sprain using Ankle Braces*

Recommended use of an ankle brace is a common clinical intervention intended to prevent ankle sprains. The results of multiple studies indicate that wearing an ankle brace can reduce the incidence of ankle sprains in sporting activities such as football (Rovere 1988), basketball (Sitler, 1994), and soccer (Tropp, 1985; Surve, 1994). Additionally, Amoroso et al. (1998) demonstrated a reduction in the incidence of ankle sprain injuries during Army paratrooper training when recruits wore an outside-the-boot brace.

At least two prospective studies have demonstrated reduction in the incidence of ankle sprains using the semi-rigid Aircast Sport-Stirrup (Aircast, Inc.) brace (Surve, 1994; Sitler, 1994). Additionally, the results of two studies offer strong evidence that a semi-rigid brace worn outside of paratroopers' boots can assist in preventing ankle injuries (Amoroso, 1998; Schumaker, 2000).



Results of other studies indicate wearing a lace-up brace, specifically the Swede-O Universal Ankle Support (North Branch, MN), may effectively reduce the incidence of ankle sprain injuries (Rovere, 1988; Sharpe, 1997).

#### *Factors that may Discourage use of Ankle Braces*

Even though ankle braces have been effective in reducing the incidence of ankle sprains, athletes may be less likely to use them if they believe a given brace will adversely influence performance. Clinicians' beliefs regarding the effect of ankle braces on functional performance may also influence decisions about brace recommendations. Considerable evidence exists, however, that ankle braces do not adversely affect functional performance (Bocchinfuso, 1994; Gross, 1994; McKean, 1995; MacPherson, 1995; Pienkowski, 1995; Verbrugge, 1996; Gross, 1997; Jerosch, 1997; Wiley, 1996; Hals, 2000). The results of only two studies contradict this general conclusion (Burks, 1991; MacKean, 1995).

Ankle brace comfort is another important issue to consider. Semi-rigid braces are made of stiffer material, are generally bulkier, and may cause more skin irritation. Gross and Liu (2003) reported no "consistent trends" across a series of studies comparing comfort between the Aircast Sport Stirrup and the Ankle Ligament Protector semi-rigid braces.

Little information is available regarding the effects of long-term ankle brace use on ankle muscle strength and function. The results of one investigation indicated no changes in postural control after using an ankle brace for four days (Palmieri, 2002). Cordova et al. (2000) investigated the effects of eight weeks use of a semi-rigid brace and a lace-up brace on peroneus longus muscle activation latency in healthy subjects. Post-testing EMG data for a sudden ankle inversion task indicated no effect of brace use on muscle onset latency. No investigators have examined the effect of long-term ankle brace use on the force producing capabilities of ankle musculature.

Some clinicians may have concerns about ankle brace use causing increased risk for injury at proximal joints. Forces must be absorbed throughout the lower extremity during landing and cutting tasks. Theoretically, greater forces may be transmitted to more proximal joints if ankle joint motion is restricted. While the effect of using an ankle brace on the risk of proximal joint injury has not been examined, Santos et al. (2004) did investigate the effect of ankle braces on knee motion. Santos et al. examined how the Active

Ankle brace (semi-rigid with straps) affected motion at the hip and knee during a one-leg stance rotation task. Subjects exhibited an increase in knee internal rotation when they wore the ankle brace during the rotation task.

#### *The Future of Ankle Brace Research*

Several recently published reviews have called for additional research on the use of ankle bracing to prevent ankle sprains. Wilkerson (2002) has encouraged researchers to assess the effectiveness of braces and taping procedures in limiting foot abduction and adduction motion in the horizontal plane. Cordova et al. (2002) noted that while numerous studies have examined the efficacy of external ankle braces in limiting passive motion, the effects of ankle braces on ankle kinematics and kinetics during dynamic activities such as running, cutting, and lateral movements are poorly understood. Finally, Gross and Liu

(2003) indicated in their review that a new generation of ankle braces is being recommended by clinicians and used by the general population. Gross and Liu recommend clinicians should be surveyed to determine which ankle braces are used most commonly. This initial effort could be followed by clinical trials to determine the effects of these braces on ankle sprain injury rates during selected activities as compared to control groups.

Additional related questions raised by Gross and Liu include: the influence ankle braces may have on injuries to more proximal lower extremity joints, the effects of long-term ankle brace use on muscle strength, and the length of time after an ankle sprain that a brace should be worn to reduce the risk of re-injury adequately.

No published data are available describing which ankle braces clinicians most commonly recommend or which braces individuals acquire on their own. Many new braces that are commonly recommended have not been included in previous research studies. Future studies will be more clinically relevant if investigators can study the effects of braces that are most commonly recommended by clinicians. Additionally, no data are available regarding the factors clinicians consider when they recommend a specific ankle brace. The purpose of this study is to address these deficiencies in the literature by answering the following research questions:

- 1) Which ankle braces do clinicians recommend and/or dispense most frequently to prevent ankle sprain injuries?



- 2) What factors related to brace use are most influential when clinicians decide to recommend specific ankle braces?
- 3) Is frequency of recommendation of ankle brace related to clinicians' beliefs about potential side effects resulting from using an ankle brace?

## Methods

### Data Collection

Survey methodology was used to collect data to address the research questions. Generation of survey items was guided by a review of the literature. The survey instrument was formatted based on the Total Design Method by Dillman (1978). The specific braces listed in the survey were chosen based on clinical experience, informal surveys of vendors and other clinicians, and a review of relevant literature. In addition, space was provided for clinicians to report other braces not included in the survey list. The survey was conducted via the internet. An initial e-mail with a link to the survey website was sent inviting the subjects to participate in the survey. Informed consent was obtained on the first page of the survey. A follow-up e-mail was sent to all subjects after two weeks. The content of the follow-up e-mail thanked those who had already participated and notified the remaining subjects that the survey would be open for ten more days. The study was approved by the Office of Human Research Ethics-Biomedical Institutional Review Board at the University of North Carolina at Chapel Hill.

### Survey Sample

The e-mail invitation to participate in the survey was sent to 2,000 potential respondents. The target population was clinicians who were either a licensed physical therapist (PTs) or a certified athletic trainer (ATCs). The principal investigator acquired e-mail addresses for 1,000 randomly selected members of the National Athletic Trainers Association (NATA).

The survey was sent to these 1,000 members of the NATA. The principal investigator also acquired the e-mail list for members of the Orthopedic Section of the American Physical Therapy Association (APTA). The survey was sent to 1,000 randomly selected members from the Orthopedic Section of the APTA list. Of the 2,000 surveys sent to participants, 131 were returned secondary to invalid e-mail addresses. Of the 1,869 subjects receiving the survey, 377 subjects responded to some portion of the survey for a response rate of 20.2 percent. See Table 1 for a full description of the subjects.

### Survey Instrument

The survey contained questions about the clinicians' experience, practice setting, and patient volume. The survey contained Sections A-F. Section A contained questions about how many patients clinicians had treated for an ankle sprain injury and the number of patients for whom clinicians had recommended a brace. Clinicians who had not treated a patient for an ankle sprain injury were skipped by the survey program to Section F to complete their participation. Section F contained questions inquiring about clinicians' professional status, clinical experience, and current practice setting. Clinicians who had treated patients for an ankle sprain injury but had not recommended an ankle brace during the last 12 months were skipped by the survey program to Section D to complete Sections D-F. Clinicians who had recommended use of an ankle brace continued to answer questions in Section A regarding the percentage of patients with an initial ankle sprain injury for whom they had recommended use of an ankle brace. The question was repeated for patients with recurrent ankle sprain injury. Finally, clinicians answered whether they had the autonomy to decide if a patient needed an ankle brace and to decide which ankle brace a patient should wear.

In Section B of the questionnaire clinicians reported which braces they recommended most often and estimated how many times they had recommended each brace during the past 12 months. Clinicians selected braces from a list of nine braces and an "other brace" option.

Clinicians also were asked to identify the braces they recommended most often, second most often, and third most often.

In Section C clinicians described the factors that are most influential for them when selecting an ankle brace. Clinicians were asked to identify the 1<sup>st</sup>, 2<sup>nd</sup>, and 3<sup>rd</sup> most influential factors.

Section D contained questions about potential brace side-effects to determine if clinicians' views about potential side effects were related to clinicians' frequency of recommendation of ankle brace. Each of the four questions asked clinicians how concerned they were about the following issues: 1) potential for reduced ankle muscle strength once a brace is no longer used, 2) potential for compromised ankle joint proprioception once the brace is no longer used, 3) potential for compromised dynamic balance once the brace is no longer used, and 4) increased risk of injury to knee joint structure. Clinicians responded



to each of the four questions by choosing from the following responses: 1) not concerned at all, 2) minimally concerned, 3) moderately concerned, or 4) greatly concerned.

Section E contained two questions inquiring how long, on average, clinicians recommend a patient wear an ankle brace after an ankle sprain injury during physical activity that poses a risk of ankle sprain injury. One question inquired about patients with a first-time ankle sprain and the second question was related to patients following a recurrent ankle sprain. Clinicians selected among the following choices: 1) not at all, 2) 1-6 days, 3) 1-4 weeks, 4) 1-3 months, 5) greater than 3 months, or 6) forever when participating in the activity.

#### *Data Analysis*

The characteristics of the survey respondents and their current clinical practice were detailed using descriptive statistics. The specific research questions were analyzed using descriptive statistics, chi-square analysis, and regression analysis.

The data to address the first research question were analyzed using descriptive statistics. This includes a report of a) the number of clinicians who recommend use of each brace, and b) the frequency each brace was listed as being the most frequently recommended, second most frequently recommended, and third most frequently recommended brace. Additionally, clinicians estimated how many times they had recommended each brace in the past 12 months.

The second research question was addressed using descriptive statistics and a chi-square analysis of the data from survey Section C. Descriptive statistics were generated for the factors clinicians consider most influential when deciding which brace to recommend. Additionally, a chi-square analysis (.05 alpha) was used to determine if the observed frequencies were different from the expected frequencies to determine the significance of the most influential factor. A second chi-square test was conducted to determine if the remaining factors were selected equally or if differences exist.

Regression analyses are employed to answer the third research question. The dependent variables are the percentage of patients for whom a given clinician recommends use of an ankle brace for initial and recurrent sprains (survey Section A, questions 2b-c). The independent variables are the responses to the questions regarding potential side effects of using an ankle brace (survey Section D, questions 1-4). Data analysis indicated that

professional status (ATC or PT) was highly correlated with the percentage of patients for whom clinicians recommended use of an ankle brace. Therefore, professional status was included as an independent variable in all regression models. Respondents who reported they did not have autonomy to decide if a patient needed an ankle brace or did not answer each of the side effect questions (Section D, questions 1-4) were excluded from the regression analysis.

## **Results**

### *Descriptive Statistics*

Table 1 provides general descriptive statistics for the survey respondents. Of the 377 respondents, 324 respondents answered the professional status question. Of those 324 respondents, 198 (61.1%) reported ATC status, 99 (30.6%) reported PT status, and 27 (8.3%) reported ATC and PT status.

The results of this survey pertain only to the respondents who confirmed professional status as an ATC or PT. The 53 subjects who did not confirm a professional status of ATC or PT were excluded from all analyses. Respondents with experience as an ATC reported a mean of 11.01 years of experience. Respondents with experience as a PT reported a mean of 12.80 years of experience. Overall respondents reported a mean of 11.45 years of experience in sports medicine and/or orthopedics. Of the respondents who reported their clinical setting(s), 49.7% (n=150) reported working in an outpatient orthopedic clinic, 33.6% (n=108) reported working with a sports team(s) (professional, college/university), 19.6% (n=63) reported working in a sports medicine clinic, 10.9% (n=35) reported working in a high school or middle school setting, 6.5% (n=21) reported working in an academic/university setting, and 7.2% (n=23) reported other miscellaneous settings. The largest number of ATCs reported working for a sports team (99 ATCs, 4 PTs, and 5 ATC/PTs). The largest number of PTs reported working in an outpatient orthopedic setting (84 PTs, 45 ATCs, and 21 ATC/PTs). Of the clinicians who reported working in a university setting or a high school/middle school setting all reported ATC status with the exception of one clinician who reported ATC and PT status (n=56).

Approximately 90% of respondents who had recommended an ankle brace reported having the autonomy to decide if a patient needed an ankle brace. Of those respondents with autonomy to



recommend use of a brace, 90% also reported having autonomy to recommend a specific brace.

Overall, respondents who had recommended ankle brace use for patients in the past 12 months reported recommending a brace to 48.1% of the patients who had an initial ankle sprain. Subjects reported recommending an ankle brace to 64.1% of their patients who had a recurrent ankle sprain. ATCs recommended an ankle brace to 53.9% of patients with an initial ankle sprain and 70.1% of patients with a recurrent sprain. PTs recommended an ankle brace to 35.5% of patients with an initial ankle sprain and 49.7% of patients with a recurrent ankle sprain.

The majority of respondents reported recommending that patients with a first-time ankle sprain should wear an ankle brace for either 1-3 months (39.3%) or 1-4 weeks (32.9%) after injury when returning to physical activity that poses a risk for ankle sprain injury. When considering patients in the past 12 months with a recurrent ankle sprain returning to previous activity, most respondents reported recommending the patients wear an ankle brace “forever when participating in the activity” (34.3%), 1-3 months (25.4%), or greater than 3 months (22.5%).

#### *Research Question 1*

The first research question examined which braces clinicians recommend most frequently to prevent ankle sprain injuries. To address this question, the data from survey section B “Most Frequently Recommended Braces” is reported using descriptive statistics. Tables 2 and 3 show the number of clinicians who recommend use of each brace. Of the clinicians who reported which braces they recommended or dispensed, 9% (n=26) reported they did not have the autonomy to decide which brace a patient should use. Therefore, for this small subset of respondents the brace or braces they dispensed may not have been the brace they most preferred. Table 4 shows clinicians’ estimates of how many times they recommended each brace in the past 12 months.

The ASO brace was recommended by clinicians with considerably greater frequency than any other brace (Table 2). The ASO brace also was the brace recommended most often as the 1<sup>st</sup>, 2<sup>nd</sup>, or 3<sup>rd</sup> most recommended brace (Table 3), and was recommended to the greatest total number of patients (Table 4). The five braces reported by clinicians as the brace they recommended most frequently (Table 2) are as follows: ASO- 36% (n=102), McDavid- 13% (n=36), T2 Active Ankle Support- 10% (n=28), Swede-O Ankle LoK- 10%

(n=27), and Aircast Air-Stirrup- 9% (n=26). For the braces recommended 1<sup>st</sup>, 2<sup>nd</sup>, or 3<sup>rd</sup> most by clinicians who recommended a brace in the past 12 months, the top five braces were as follows: ASO- 44% of clinicians (n=126), Aircast Air-Stirrup- 28% (n= 79), McDavid Sports lace-up- 28% (n=79), Swede-O Ankle Lok- 26% (n=75), and T2 Active Ankle Support- 22% (n=63). See Table 4 for a report of frequencies of total number of braces clinicians recommended to patients in the past 12 months. Ten clinicians reported recommending the ASO brace to greater than 51 patients. While the Aircast Air-stirrup brace along with the McDavid lace-up brace was recommended by the second highest number of clinicians (n=79), fifty-four of those clinicians only recommended the Aircast Air-stirrup brace to between 1-5 patients in the past year.

#### *Research Question 2*

The second research question regarding the factors clinicians consider when deciding which brace to recommend was addressed using descriptive statistics and a chi-square analysis of the data from survey Section C. Clinicians who did not have autonomy to decide if a patient needed a brace and to decide which specific brace to recommend were excluded from the chi-square analysis. The frequency with which each factor is selected as the most influential, second most influential, and third most influential factor is shown in Table 5. Fifty-four percent (n=125) of the respondents reported “effectiveness in preventing ankle sprain” as the most influential factor when selecting an ankle brace. The factor selected with the next most frequency as most influential was “severity of ankle sprain” by fourteen percent (n=32) of respondents. “Effectiveness in preventing ankle sprain” was selected significantly more frequently than any other factor (Table 5). A chi-square analysis (.05 alpha) was used to determine if the observed frequencies were different from the expected frequencies to determine the significance of the most influential factor. The “other” category was not included in the analysis since a low frequency is expected for this type of category.

The chi-square analysis indicated an abnormal distribution of the responses with significance at the .005 level ( $\chi^2 = 328.4$ ,  $df=6$ ) with “effectiveness” explaining most of the variability ( $\chi^2=268.3$ ). A second chi-square test was conducted to determine if the remaining factors were selected evenly or if differences exist. Excluding “effectiveness,” a chi-square test was performed to examine the distribution of total mentions as the 1<sup>st</sup>, 2<sup>nd</sup>, or 3<sup>rd</sup> most influential factor. After



“effectiveness in preventing ankle sprain”, “comfort of the brace” received the most mentions as the 1<sup>st</sup>, 2<sup>nd</sup>, or 3<sup>rd</sup> most influential factor when selecting an ankle brace (Table 6). The chi-square test proved significant at the .005 level ( $\chi^2=36.0$ ,  $df=5$ ) with “comfort” explaining most of the variability ( $\chi^2=28.2$ ).

### Research Question 3

Research question three pertained to whether clinicians’ beliefs about potential side effects from using an ankle brace were related to decisions about prescribing a brace. A regression analysis was employed to answer research question three. The dependent variable is the percentage of patients for whom a given clinician recommends use of an ankle brace (survey Section A, question 2b). The independent variables are the responses to the questions regarding potential side effects of using an ankle brace (survey Section D, questions 1-4). The frequency and percentage of clinicians concerned about each of the potential side effects are reported in Table 9. In addition to the side effect variables, ATC status was included as a control variable in all the regression models. In this survey ATCs recommended an ankle brace to a higher percentage of patients. Therefore, the primary investigator decided to control for professional status in the regression models. A repeat analysis was performed with a different dependent variable (survey Section A, question 2c.) to determine whether the relationship changes if the patient involved has had a recurrent sprain. Respondents who reported they did not have autonomy to decide if a patient needed an ankle

brace were excluded from the regression analysis. Additionally, only respondents who answered each of the side-effect questions (Section D, questions 1-4) were included in the regression analysis.

Professional status was the characteristic most closely related to the likelihood a clinician would recommend an ankle brace ( $p < .001$ ). Professional status was held constant for all regression analyses. Clinicians reported concern about each of the side effect variables, but only the “strength” variable was related to the percentage of patients for whom clinicians recommended an ankle brace. Clinicians’ concern about potential for “reduced ankle musculature strength” once the brace is no longer used was significantly related to whether a respective clinician recommended use of an ankle brace to a patient after an initial ankle sprain (Table 7). Clinicians who were minimally concerned ( $p=.03$ ), moderately concerned ( $p=.013$ ), or greatly concerned ( $p=.018$ ) about “reduced ankle musculature strength” were all less likely to recommend use of an ankle brace after an initial ankle sprain than clinicians who were not concerned at all. Clinicians’ concerns about compromised ankle joint proprioception, compromised dynamic balance, and risk of injury to knee joint structures were not significantly related to whether clinicians recommended an ankle brace after an initial ankle sprain (Table 7). Results of regression analyses testing the relationship between beliefs about these side effects and recommending use of an ankle brace after a recurrent ankle sprain (Table 8) revealed that none of the factors were significantly related ( $p > .05$  all tests).

**Table 1: Descriptive Statistics**

	N	Percent
<b>Clinicians' Professional Status:</b>		
ATC	198	61.1
PT	99	30.6
Both ATC and PT	27	8.3
Total	324	100
<b>Clinicians' Clinical Setting*:</b>		
Sports Team	108	33.3
Sports Medicine	63	19.4
Outpatient Orthopedic	150	46.3
University	21	6.5
High School/ Middle School	35	10.8
Other	23	7.1

\* note: since respondents were allowed to select more than one setting percents add to > 100



**Duration of brace use recommended by clinicians after an Initial Sprain :**

Not at all	21	7.5
1 - 6 days	26	9.3
1 - 4 weeks	92	32.9
1 - 3 months	110	39.3
> 3 months	21	7.5
Forever when participating in the activity	10	3.6
Total	280	100

**Duration of brace use recommended by clinicians after a Recurrent Sprain:**

Not at all	6	2.1
1 - 6 days	8	2.9
1 - 4 weeks	36	12.9
1 - 3 months	71	25.4
> 3 months	63	22.5
Forever when participating in the activity	96	34.3
Total	280	100

**Table 2: Number of Clinicians Who Identified Brace as the Most Frequently Recommended**

Brace	N	Percent
ASO	102	36
McDavid Sports Medical Products lace-up	36	13
T2 Active Ankle Support	28	10
Swede-O Ankle LoK	27	10
Aircast Air-Stirrup (Aircast)	26	9
RocketSoc	14	5
Universal Ankle Stirrup	7	2
Ankle Brace Lock	5	2

Note: All other braces selected by less than 2 percent of the respondents

**Table 3: Number of Clinicians Who Identified Brace as First, Second or Third Most Recommended Brace**

Brace	N	Percent
ASO (Medical Specialties Charlotte, NC)	126	44
Aircast Air-Stirrup (Aircast)	79	28
McDavid Sports Medical Products lace-up	79	28
Swede-O Ankle LoK (the original 'Swede-O')	75	26
T2 Active Ankle Support (Active Ankle)	63	22
RocketSoc (DonJoy)	27	10
Universal Ankle Stirrup (DonJoy)	22	8
Ankle Brace Lock (Breg, Vista, CA)	13	5
Ankle Ligament Protector (DonJoy)	11	4

Note: All other brace

**Table 4: Frequency of Recommendation for Five Most Frequently Recommended Braces\***

Brace	Number of Times Brace Recommended in Last 12 Months					
	51+	26-50	16-25	11-15	6-10	1-5
ASO (Medical Specialties Charlotte, NC)	10	12	19	19	25	41
T2 Active Ankle Support (Active Ankle)	4	4	4	5	10	36
McDavid Sports Medical Products lace-up	3	2	5	4	17	48
Swede-O Ankle LoK (original 'Swede-O')	2	2	4	6	13	48
Aircast Air-Stirrup (Aircast)	2	0	2	6	15	54

\*Entries in each column indicate the number of clinicians who have recommended the corresponding braces at the indicated frequency

**Table 5: Number of Clinicians Who Identified Factor as Most Influential When Selecting a Brace**

	N	Percent
Effectiveness	125	54
Severity of Ankle Sprain	32	14
Comfort	22	10
Availability	19	8
Compliance	14	6
Performance	9	4
Cost	4	2
Other	5	2
<i>Total</i>	<i>230</i>	<i>100</i>

Chi-square: 328.4 \*\*\*

Degrees of Freedom 6

\*\*\*p<0.005

Note: "Other" not included in calculation of Chi-Square

**Table 6: Number of Clinicians Who Identified Factor as 1st, 2nd, or 3rd Most Influential\***

	N	Percent
Comfort	126	55
Cost	79	34
Severity of Ankle Sprain	71	31
Compliance	70	30
Performance	65	28
Availability	62	27
Other	8	3

\* The most common response, "effectiveness", was excluded from this analysis

Chi-square: 36.0 \*\*\*

Degrees of Freedom 5

\*\*\*p<0.005

Note: "Other" not included in calculation of Chi-Square

**Table 7: Regression of recommendation of brace use after initial ankle sprain onto clinician beliefs about potential side effects**

	Coefficient <sup>a</sup>		SE	P>t
<b>Reduced Strength:</b>				
Minimum Concern	-12.461	*	5.712	0.030
Moderate Concern	-15.978	*	6.378	0.013
Great Concern	-15.698	*	6.611	0.018
ATC	22.684	***	4.053	0.000
constant	37.486		5.981	0.000
df	4			
Adjusted R2	0.125			
<b>Compromised Proprioception:</b>				
Minimum Concern	0.596		6.117	0.922
Moderate Concern	-3.346		6.558	0.610
Great Concern	-11.871		7.092	0.095
ATC	23.987	***	4.152	0.000
constant	27.158		6.389	0.000
df	4			
Adjusted R2	0.119			
<b>Compromised Dynamic Balance:</b>				
Minimum Concern	6.156		5.362	0.252
Moderate Concern	-4.003		6.008	0.506
Great Concern	-8.883		7.020	0.207
ATC	23.169	***	4.105	0.000
constant	24.367		5.748	0.000
df	4			
Adjusted R2	0.129			
<b>Risk of Injury to Knee Joint:</b>				
Minimum Concern	-7.472		4.259	0.080
Moderate Concern	-7.414		5.993	0.217
Great Concern	0.924		10.540	0.930
ATC	23.325	***	4.108	0.000
constant	29.681		4.601	0.000
df	4			
Adjusted R2	0.113			
N	284			

<sup>a</sup>OLS unstandardized coefficients; Reference category is No Concern at All \*p<0.05

\*\*p&lt;0.01 \*\*\*p&lt;0.001

**Table 8: Regression of recommendation of brace use after recurrent ankle sprain onto clinician beliefs about potential side**

	Coefficient <sup>a</sup>	SE	P>t
<b>Reduced Strength:</b>			
Minimum Concern	-8.799	6.769	0.195
Moderate Concern	-11.940	7.557	0.115
Great Concern	-4.706	7.834	0.549
ATC	27.184	*** 4.803	0.000
constant	44.248	7.087	0.000
df	4		
Adjusted R2	0.108		
<b>Compromised Proprioception:</b>			
Minimum Concern	1.042	7.252	0.886
Moderate Concern	-3.883	7.775	0.618
Great Concern	-1.241	8.408	0.883
ATC	27.162	*** 4.923	0.000
constant	37.631	7.574	0.000
df	4		
Adjusted R2	0.101		
<b>Compromised Dynamic Balance:</b>			
Minimum Concern	4.775	6.38705	0.455
Moderate Concern	-0.870	7.15654	0.903
Great Concern	1.986	8.36215	0.812
ATC	27.704	*** 4.89034	0.000
constant	34.188	6.84758	0.000
df	4		
Adjusted R2	0.103		
<b>Risk of Injury to Knee Joint:</b>			
Minimum Concern	-2.599	5.03472	0.606
Moderate Concern	-1.150	7.08482	0.871
Great Concern	5.057	12.4595	0.685
ATC	28.074	*** 4.85560	0.000
constant	37.399	5.43900	0.000
df	4		
Adjusted R2	0.101		
N	284		

<sup>a</sup>OLS unstandardized coefficients; Reference category is No Concern at All \*p<0.05

\*\*p&lt;0.01 \*\*\*p&lt;0.001

**Table 9. Frequency and percentage of clinicians reporting amount of concern about potential side effects from brace use**

	N	Percent
<b>Potential for reduced ankle musculature strength</b>		
No Concern	40	14.08
Minimal Concern	126	44.37
Moderate Concern	65	22.89
Great Concern	53	18.66
<b>Potential for compromised dynamic balance</b>		
No Concern	47	16.55
Minimal Concern	129	45.42
Moderate Concern	73	25.7
Great Concern	35	12.32
<b>Increased risk of injury to knee joint structures</b>		
No Concern	92	32.39
Minimal Concern	140	49.3
Moderate Concern	42	14.79
Great Concern	10	3.52
<b>Potential for compromised ankle joint proprioception</b>		
No Concern	34	11.97
Minimal Concern	121	42.61
Moderate Concern	82	28.87
Great Concern	47	16.55
<i>Total</i>	284	

**Discussion**

Our response rate of 20.2% was comparable with the reports in the literature for mass e-mailings without direct personal contact (Hamilton, 2003; Kaplowitz, Hardwick, and Levine 2004; Cole 2005). The response to mass e-mails is generally very low. Response rates are usually increased by making direct contact with the participant and by offering incentives. Because of the low response rate, the findings of this study may not be generalizable to all ATCs and PTs or even those within the NATA and APTA Orthopedic section. Given the large sample of respondents, however, the results of the survey warrant serious consideration.

A follow-up survey offered to a smaller, more focused group of clinicians with incentives included may result in a higher response rate and increase the confidence in the current findings. Another limitation of the current study is that the term "ankle sprain" was not defined within the survey. Respondents may have used their own definition, and this may have influenced individual answers to questions.

Athletic trainers responded to the present survey at twice the rate of physical therapists. Access to the e-mail list of the Sports Section of APTA was denied. Members of the Orthopedic Section of the APTA were sampled as an alternative. Athletic trainers may be more likely to treat patients with an ankle sprain in their respective practice settings. More athletic trainers than physical therapists may have replied to the survey because the survey was more relevant to the practice of athletic trainers. If access to the Sports section members had been granted, response rates of physical therapists may have been more similar to the response rate of the athletic trainers.

ATCs and PTs differ regarding the number of their patients to whom they recommend wear a brace after an ankle sprain injury. ATCs recommended an ankle brace to a higher percentage of their patients than physical therapists for both initial ankle sprains (53.9% versus 35.5%) and for recurrent sprains (70.1% versus 49.7%). Regression analyses were conducted to determine whether professional status or practice setting explained more of the variability of the percentage



of patients for whom clinicians recommend an ankle brace. Clinicians who reported working in an outpatient orthopedic clinic were included in a regression analysis to examine differences in brace recommendations between PTs and ATCs working in an outpatient orthopedic setting. Of clinicians working in an outpatient orthopedic clinic, ATCs were significantly more likely to recommend an ankle brace than PTs ( $p < .001$ ,

$R^2 = .13$ ). An additional regression analysis, including only ATCs, was conducted to examine differences in brace recommendations between ATCs in different work settings. For ATCs who work in outpatient orthopedic and sports team settings, practice setting explained almost none of the variability of how often they recommended an ankle brace after an initial ankle sprain ( $p = .761$ ,  $R^2 = .0008$ ). Both regression analyses were also repeated for data on recurrent sprains, and the results were almost identical. When controlling for professional status, the frequency of brace recommendation was not influenced by practice setting in this study. The strongest predictor of the likelihood of brace recommendation in this study was professional status.

ATCs, on average, treat patients who are functioning at higher levels of activity or higher levels of competition than orthopedic PTs. Given that a patient visiting an ATC is returning to a higher activity level or higher level of competition than the typical patient visiting a PT in an orthopedic clinic, it is reasonable that ATCs recommend use of an ankle brace to a higher percentage of their patients upon returning to their previous level of function.

Overall, clinicians reported recommending an ankle brace to more patients who had a recurrent ankle sprain than patients who had incurred an initial ankle sprain. Clinicians recommended an ankle brace to patients with an initial ankle sprain 48.1% of the time and to patients with a recurrent sprain 64.1% of the time. Clinicians also recommended patients wear the ankle brace for a longer period of time if they had a recurrent sprain.

The greatest percentage of clinicians (39.3%) recommended patients with an initial ankle sprain wear an ankle brace for 1-3 months upon returning to physical activity posing a risk of ankle sprain injury. The greatest percentage of clinicians (34.3%) recommended patients with a recurrent ankle sprain, however, continue to wear a brace forever when participating in physical activity posing a risk of ankle sprain injury. The apparent assumption by the clinicians who participated in

this study is that if the patient has had more than one ankle sprain injury he or she is at greater risk for re-injury than someone with an initial sprain injury. Additionally, clinicians may be more optimistic that rehabilitation alone will be sufficient for someone with an initial ankle sprain. Individuals who have had recurrent sprains may have previously participated in rehabilitation which was unable to prevent a subsequent sprain. The difference in practice patterns between brace recommendation for an initial ankle sprain versus brace recommendation for a recurrent ankle sprain in this study, however, is not supported by the current literature. The bulk of the literature indicates that an individual with one or more ankle sprains is at higher risk for a subsequent ankle sprain (Surve et al., 1994; McKay et al., 2001; Verhagen et al., 2004). The established comparison is between subjects who have had no ankle sprains and subjects who have had one or more and are now at greater risk for future injury. No contrast currently exists in the literature comparing subjects with a history of one ankle sprain versus those with two or more. A subject with an initial ankle sprain, therefore, should be considered as a member of the higher risk category. Future research could investigate whether the injury risk of a participant with a history of one ankle sprain is different from participants with a history of two or more injuries. Currently, however, we recommend use of an ankle brace for subjects who have had an initial ankle sprain and who then return to activities which pose a risk of ankle sprain injury.

The ASO brace was recommended by considerably more clinicians and to a higher number of patients per clinician than any of the other braces in this study. To date no published studies have examined the injury rates of subjects who wear the ASO ankle brace. If the ASO brace is the most commonly recommended brace among clinicians, prospective, controlled trials are needed to examine the ankle sprain injury rates for subjects who wear the ASO brace. While the experience of clinicians may suggest the efficacy of an ankle brace, scientific evidence is needed to confirm the effectiveness of commonly used braces. The second tier of braces most commonly recommended in this study consisted of the Aircast Air-Stirrup, McDavid Sports Medical Products Lace-up brace, Swede-O Ankle LoK, and T2 Active Ankle support. Similar to the ASO brace, no prospective, controlled studies have examined the injury rates of the McDavid lace-up brace or the T2 Active Ankle brace.

Clinicians sampled in this study reported that effectiveness in preventing ankle sprain injury and comfort of the brace were the two factors they



considered most influential when selecting an ankle brace. Effectiveness in preventing ankle sprain was the dominant factor reported by this group of clinicians to influence their selection of an ankle brace. This is not surprising given the role of clinicians to promote and maintain the health of patients. Additionally, injury prevention capability of a brace may be of little consequence if a patient will not wear the brace or cannot acquire the brace. Therefore, clinicians must consider additional factors when recommending a brace. The factor clinicians considered as second most influential was comfort of the brace.

Additional factors including availability of the brace, cost of the brace, likelihood of compliance, influence on performance, and severity (grade) of the ankle sprain each received considerable mention as being important to clinicians in our survey but significantly less than both effectiveness in preventing ankle sprain and comfort.

Although clinicians reported effectiveness in preventing ankle sprain as the most influential factor when selecting an ankle brace, it is important to note that the brace (ASO) clinicians recommend most frequently has no associated empirical evidence to date supporting that its use results in a reduction of ankle sprain injuries. Again, this disconnect demonstrates a need for a clinical trial to determine the effectiveness of the ASO brace in preventing ankle sprain injury.

Clinicians who were concerned about reduced ankle musculature strength after discontinuing use of an ankle brace were less likely to recommend use of an ankle brace to patients after an initial ankle sprain. However, this issue has not been addressed in the literature. We do not have sufficient evidence to support or dismiss the clinicians' concerns. Our data suggest, however, that some clinicians are withholding an

efficacious, protective intervention secondary to concern about an unproven side effect. We recommend a controlled trial be performed for a minimum 6-8 weeks to determine if use of some of the most commonly used ankle braces influence the strength of ankle joint musculature. Healthy subjects and subjects who have had a recent sprain might be appropriate for such a study. Examining the effect of extended use of ankle brace on ankle musculature strength could prove useful in guiding clinicians' decision making about recommending an ankle brace.

### Conclusion

The results of this study detail the current practice of a sample of clinicians in recommending ankle braces highlighting where clinical practice diverges from the literature. Clinicians in this study considered effectiveness in preventing an ankle sprain the most important factor when recommending an ankle brace. The next most influential factor was brace comfort. Clinicians in this study who were concerned about reduction in ankle muscle strength upon discontinuing using an ankle brace were less likely to recommend use of an ankle brace to a patient after an initial ankle sprain.

The findings from this study demonstrate the need for clinical trials to guide future clinical practice. The issue of potential reduction in strength requires study. Future studies examining the influence of ankle braces on ankle joint motion during dynamic motion or examining injury rates when using an ankle brace should include the ASO brace since this was the most frequently recommended brace. Additionally, investigators should consider including the Aircast Air-Stirrup, McDavid Sports Medical Products Lace-up, Swede-O Ankle LoK, and T2 Active Ankle Support braces in future studies.

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