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IMPACT OF AN OUTSIDE-THE-BOOT ANKLE BRACE ON SPRAINS ASSOCIATED WITH MILITARY AIRBORNE TRAINING

U S ARMY RESEARCH INSTITUTE
OF
ENVIRONMENTAL MEDICINE
Natick, Massachusetts

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MEDICAL RESEARCH & DEVELOPMENT COMMAND

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Ankle injuries account for 30%-60% of parachute jump-related injuries. To determine if ankle bracing would reduce the incidence of jump-related ankle sprains, a prospective, randomized trial of an outside-the-boot ankle brace was conducted. Volunteers were sought from four classes at the US Army Airborne School at Fort Benning, Ga. Of 1414 students briefed, 777 volunteered; 389 were assigned to wear braces, 388 served as controls. Of these, 745 students completed all study requirements (369 brace wearers and 376 non-brace wearers). Each volunteer made 5 static-line jumps for a total of 3674 jumps. The incidence of ankle sprains was 1.9% in non-brace wearers, and 0.3% in brace wearers (risk ratio 6.3:1, p=0.04). Other injuries did not appear to be affected by the brace. Overall, 5.1% of the non-brace group, and 4.3% of the brace group experienced at least one injury, including minor contusions. The risk ratio for all injuries was 1.2:1 (non-brace to brace groups), p=0.92. These data indicate that the incidence of inversion ankle sprains can be significantly reduced by use of an outside-the-boot ankle brace with no increase in the risk of other injuries.

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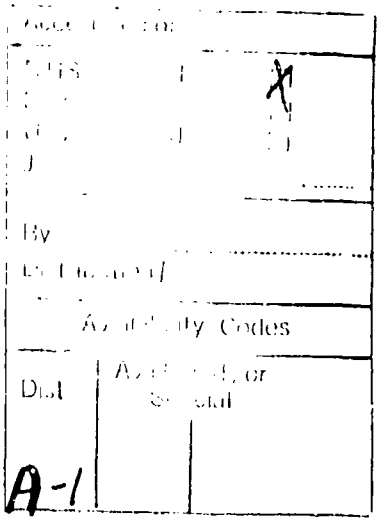

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EXECUTIVE SUMMARY

Ankle injuries account for 30%-60% of parachute jump-related injuries. To determine if ankle bracing would reduce the incidence of jump-related ankle sprains, a prospective, randomized trial of an outside-the-boot ankle brace was conducted. Volunteers were sought from four classes at the US Army Airborne School at Fort Benning, Ga. Of 1414 students briefed, 777 volunteered; 389 were assigned to wear braces, 388 served as controls. Of these, 745 students completed all study requirements (369 brace wearers and 376 non-brace wearers). Each volunteer made five static-line parachute jumps for a total of 3674 jumps. The incidence of ankle sprains was 1.9% in non-brace wearers, and 0.3% in brace wearers (Risk ratio 6.3:1, p=0.04). Other injuries did not appear to be affected by the brace. Overall, 5.1% of individuals in the non-brace group, and 4.3% of individuals in the brace group experienced at least one injury, including minor contusions. The risk ratio for all injured individuals was 1.2:1 (non-brace to brace groups), p=0.92. These data indicate that the incidence of inversion ankle sprains can be significantly reduced by use of an outside-the-boot ankle brace with no increase in the risk of other injuries.

INTRODUCTION

Airborne soldiers have long been among those at the highest risk of serious injury in the Army. Reported injury rates among paratroopers vary widely, with published rates ranging from 0/1000 jumps to as high as 110/1000 jumps (Lillywhite, 1991; Miser, Lillegard et al., 1991) . These rates are influenced by a multitude of factors including environmental conditions, individual paratrooper characteristics, equipment, study design and quality, reporting bias, quality of data retrieval, and variations in accepted definitions of injury.

Few well-designed prospective epidemiologic studies have been conducted, and fewer still intervention trials. Lillywhite (1991) reported annual injury rates of between 0.6%-1.2% (6-12/1000) and rates of 0%-7.9% (0-79/1000) for mass descents among Royal Army paratroopers. Pirson and Verbiest (1985), and Pirson and Pirlot (1990) reported severe injuries occurring at a rate of 1.2/1000 jumps, where severe was defined as positive X-rays, a fracture, or a dislocation; moderate injuries occurred at a rate of 5/1000 jumps. In 1991, a USARIEM study of basic Airborne Training, with a less restrictive definition of injury, documented injury rates as high as 14.3% (70/490) among soldiers making five jumps over a one-week period. Ankle injuries in this study accounted for 25.5% of all injuries (Amoroso, Jones et al., 1991)

Ankle injuries represent the predominate injury in both military and civilian parachuting and are well described in both. Ankle injuries account for 30%-60% of all military parachute injuries according to Davison (1990). Kirby (1974) documented that 30% of 520 injuries were ankle fractures or sprains. Petras and Hoffman (1983) reported that 58% (41/71) of serious injuries confirmed by X-ray were ankle injuries, and Lowdon and Wetherill (1989) stated 51% of injuries in their study were to the ankle (52/102). In a study of civilian parachute injuries, 37% (65/176) were ankle injuries (Ellitsgaard, 1987). During the carefully controlled conditions of Airborne school, 4.7% (23/490) of students sustained ankle injuries while completing five jumps during "jump week" (Amoroso, Jones et al., 1991). During Operation Just Cause in Panama (Miser, Lillegard et al., 1991), 8.2% of Rangers (51/624) sustained ankle injuries, 39% of these soldiers had to be evacuated, and 27% were non-ambulatory. Acute, disabling injuries are a great concern for military operations, since soldiers who cannot get off a

drop zone by themselves are vulnerable to enemy fire or capture. Injured soldiers often require the assistance of one or more other soldiers to get off the drop zone. The need to assist soldiers with disabling sprains can reduce the effectiveness of an airborne assault force by several fold.

Prevention strategies for ankle injuries associated with parachute landings have not yet been adequately developed. Athletic training and sports medicine literature, however, suggest bracing or taping may prevent ankle injuries for other vigorous physical activities (sports) where a high incidence of such injuries is the norm. Several biomechanical studies demonstrated the benefits of lace-up braces (Bunch, Bedarski et al., 1985), air stirrups (Kimura, Nawoczenski et al., 1987), and taping and semi-rigid orthoses (Gross, Bradshow et al., 1987). Two prevention trials, one using a lace-up brace for football (Rovere, Clarke et al., 1988) and the other for cadets' basketball (Sitler, Ryan et al., 1994), also demonstrated the efficacy of ankle bracing to prevent sports injuries. One recent trial of an inside-the-boot ankle brace (Lillegard and Doukas, 1991) strongly suggests that braces can afford a safe, effective method of protecting the ankle. Four hundred Rangers participated in a controlled study of a semi-rigid inside-the-boot ankle brace. In this study there were no ankle injuries among 200 Rangers jumping with the brace while there were four ankle injuries among the 200 controls jumping without the brace. The drawback to the inside-the-boot brace, however, was that the device fit poorly in the boot, was difficult to adjust, made free ambulation more difficult, and was difficult to remove.

Purpose: The objective of this study was to determine whether an outside-the-boot ankle brace would reduce the incidence of parachute jump-related injuries during airborne training. Our hypothesis was that these braces would effectively prevent inversion/eversion ankle injuries, the predominant type of jump-related injuries.

METHODS

Study Design: This prospective randomized trial was conducted in three phases (Phase I, baseline screening; Phase II, parachute jump; Phase III, follow-up). The first phase consisted of a detailed volunteer briefing, the signing of informed consent documents, and the completion of screening questionnaires. The screening questionnaires were used to collect data on demographics, age, race, gender, an assessment of physical fitness, and a history of past injuries and illnesses.

At the start of the second phase, volunteers were randomly assigned to brace and non-braced groups. Ankle braces were distributed to volunteers in the brace group and each attempted to complete five static-line parachute jumps as required by the airborne school for graduation.

The third phase of the study consisted of medical follow-up of injuries. Soldiers were examined on the drop zone whenever their injuries were immediately evident. All troop medical clinic and hospital emergency department records of participants were also examined. The Airborne Post-Jump Questionnaire was administered after each jump and the Airborne Injury Follow-up and Ankle Brace Acceptability Questionnaires was administered after the fifth or final jump.

Context of the Study: The study was conducted at Fort Benning, Ga., with the 1st Battalion, 507th Parachute Infantry, US Army Basic Airborne Course. The course consisted of three weeks of training in various aspects of parachuting. Descriptions of these activities can be found in FM 57-220 Basic Parachuting Techniques and Training. Primary activities of the first week (Ground Week) included airborne orientation (2 hours), physical training (4 hours), aircraft exit (mock door) training (5 hours), 34-foot tower training, and parachute landing falls (PLFs) (14 hours). During the second week (Tower Week) students engaged in physical training (5 hours), Mock Door training (3 hours), 34-foot tower training (6 hours), suspended harness training (4 hours), swing landing trainer (7 hours), free tower (11 hours), and methods of recovery (3

hours). In the third and final week (Jump Week), they made five static-line parachute jumps.

Volunteers: Potential volunteers for this study included all students ages 18 and older, enrolled in one of four successive classes of the basic airborne course. In all, 1414 soldiers, sailors, marines, and airmen were briefed on the nature of the study. Of these students, 777 (55%) volunteered and signed consent forms.

Prior to jump week, students were assigned by the school to groups called "sticks" (or "chalks"). Each student is assigned a number or position within the stick, which they maintain throughout the final week of the training. Each stick is made up of approximately 30 individuals. The assignment of brace wearers was done within each stick. Just prior to the first jump, volunteers were assigned either to wear braces for all five jumps, or to be part of the control group. Volunteers remained in their respective groups for the entire study.

A systematic random sample was selected by picking a number from a random number table. If the number was even, then all even-numbered stick members who were volunteers were given braces. Conversely, if the number was odd then all odd-numbered volunteers in the stick wore braces. Once assigned to wear braces, individuals could not switch groups. This randomization method was used to ensure that there would be minimal opportunity for differential treatment of brace wearers based upon stick position, side of aircraft exit, time of jump, or length of time individuals spent during various stages of the process. Nonvolunteers were unaffected by this process, and switching either among volunteers or between volunteers and nonvolunteers was specifically prohibited.

Phase I: Screening Phase. Each volunteer, regardless of whether they were assigned to wear braces or not, completed a screening questionnaire. The screening questionnaire requested information on demographic factors such as age, race, gender, rank, experience, occupational specialty, self-assessment of physical fitness, and history of injuries and illnesses (see Appendix A). To

assess physical fitness, we collected Army Physical Fitness Test (APFT) score cards from the unit, which contain height, weight, age, number of push-ups and sit-ups performed in two minutes, and the two-mile run time (each individual, including members of the Air Force, Navy, and Marine Corps, must pass the APFT prior to acceptance into the basic airborne course).

Phase II: Jump Phase. Braces were issued at "Jump Branch," the area where students make final preparation for their jumps. Instruction was provided on the proper use of the braces, and braces were individually inspected and adjusted by study staff prior to the final Jump Master Paratrooper Inspection (JMPI). Soldiers wore their braces continuously from the time of JMPI, through the entire jump sequence, and during the march from the drop zone to the assembly point "en trucking" area from which they were bussed back to the airfield.

Each soldier, with rare exception, made five jumps during jump week. The scheduled sequence and types of jumps were as follows: 1st jump, an individual exit with a T-10B parachute; 2nd jump, a mass exit carrying equipment using a T-10B parachute; 3rd jump, an individual exit using an MC1-1B parachute; 4th jump, a nighttime jump, a mass exit with equipment using a T-10B parachute and; 5th jump, an individual exit using the MC1-1B parachute. The five jumps were made from either a C-141 or C-130 aircraft. Due to weather conditions, only one class accomplished a night jump.

Phase III: Follow-up. Medical follow-up began at ground contact. An orthopedic surgeon examined all individuals who could not walk off the drop zone. The study staff checked all troop medical clinic (TMC) and Army Hospital or Emergency Department (ED) logs daily. We obtained copies of TMC and ED logs for all health care visits by volunteers. Data from clinical records were extracted, coded, and entered into a microcomputer database using the DataEase database management program.[1] All injured study participants were

[1] Dataease for DOS, version 4.2. DataEase International, Trumbull CT.

examined by orthopedic staff and their diagnoses confirmed prior to the start of the next day of training.

Injuries: An injury was defined as any musculoskeletal or traumatic condition that occurred between the time of aircraft exit and completion of the march off the drop zone, which resulted in either an inability to clear the drop zone, or an injury diagnosis at the TMC or the hospital/emergency department.

For the purpose of this study, ankle injuries were separated into three categories: sprains, strains and fractures. A sprain was defined by ligament injury severity and anatomic location similar to classifications developed by O'Donoghue (1970), Chapman (1975), Saunders (1980), Hamilton (1982) and Mack (1982). Grade I sprains consisted of a painful ligament with no swelling or instability (anterior drawer of <5 mm and/or inversion/eversion stress of <10 degrees). Grade II sprains were characterized by swelling, moderate pain, slight instability (anterior drawer of 5-8 mm and/or inversion/eversion stress of 10-20 degrees), and a firm end-point on stress. Grade III sprains were characterized by marked swelling with obvious hemorrhage, moderate to severe pain on palpation, instability (anterior drawer of >8 mm and/or inversion/eversion stress of >20 degrees), and a soft or nonexistent end-point to stressing.

Ankle syndesmosis ligament injuries were similarly classified. Grade I syndesmosis sprains were characterized by pain along the distal syndesmosis and anterior and/or posterior tibia fibula ligaments, but no increase in pain with external stress testing. Grade II syndesmosis injuries had increased pain to palpation and external stress testing. Grade III syndesmosis injuries were characterized by severe pain on palpation, external rotation, and weight bearing, as well as frank diastasis of the ankle mortise.

Muscle strains were similarly defined. Grade I strains were tender along the tendon or musculotendinous junction with normal muscle strength (5/5) and active joint motion. A Grade II strain was associated with increased swelling and hemorrhage, moderate tenderness and loss of strength (4/5-3/5). Grade III strains had complete loss of muscle function associated with moderate to severe pain and frequently with a defect in the muscle or tendon.

Fractures were defined as either closed or open. The classification of Gustilo and Anderson (1976) was used to define open fractures. In addition,

fractures were described by anatomic location and type (e.g., stress, intra-articular, transverse, oblique, comminuted and bone loss).

Routine X-rays were obtained for all acute ankle injuries at the local military medical treatment facility. Other specialized tests (e.g., ankle arthrogram, stress X-rays, MRI, CAT scan and bone scans) were obtained as indicated by the clinical situation.

Immediately after each jump, an Airborne Post-Jump Questionnaire was delivered to each volunteer at the "en trucking area," the area where they assembled to turn in their parachutes and wait for buses. The Airborne Post-Jump Questionnaire was designed to gather detailed information regarding specific aspects of the jump such as type of chute, equipment carried, hazards encountered, and landing surface (see Appendix B).

In all, each volunteer completed five Airborne Post-Jump Questionnaires. After the fifth (final) jump, each volunteer completed one Airborne Injury Follow-up and Brace Acceptability Questionnaire in addition to the final Airborne Post-Jump Questionnaire. The Airborne Injury Follow-up and Brace Acceptability Questionnaire was intended to document specific information regarding injuries the students sustained during the training, as well as subjective information regarding the performance and acceptability of the braces (see Appendix C).

Description of the Braces: The braces were purchased from the Aircast Corporation of Summit, N.J. The braces themselves are similar to the Aircast Walking brace used in various acute injury management settings over the past 19 years. The braces are made of a .125 inch molded Kydex[2] plastic. The straps, Velcro and D rings are made of nylon. The braces were available in three sizes--small, medium and large--in both a right and left foot version (see Appendix D for photographs).

Each brace has a dual-compartmentalized aircell lining, which provides a conforming fit and cushioning under the stress of inversion. The distal compartment is permanently sealed and provides a nondisplaceable cushion

[2]Alloy of acrylic and PVC manufactured by Rhom and Haas, chosen for its excellent rigidity, impact resistance and thermoformability.

over the malleolus. The main aircell included a self-sealing valve that permits inflation adjustment with a special filling tube. Adjustment was not necessary for our study.

The brace was designed to allow full ambulation by allowing full dorsi and plantar flexion, and near normal physiologic inversion/eversion of the ankle. The braces are particularly effective at preventing *extremes* of inversion and eversion.

Statistics: For descriptive data, means of the brace and non-brace groups were analyzed using student t-tests. Incidence data (student volunteers injured/total student volunteers) were analyzed using a 2 X 2 chi square analysis [injury (yes/no) by brace use (yes/no)].

RESULTS

Of the 777 original volunteers who agreed to participate, 745 (96%) completed all study requirements. All injured volunteers are included in the analysis. Of these, 369 (49.5%) wore braces, 376 (50.5%) did not. Brace wearers completed 1,825 jumps, non-brace wearers completed 1,849, for a total of 3,674 jumps by study participants. Descriptive characteristics of brace and non-brace volunteers are displayed in Tables 1a and b. This was a young, physically fit population (Table 1a) that was comprised of predominately white male soldiers. Approximately one-fifth of the participants were smokers, and half had a history of a previous ankle sprain. Data in these tables indicate the comparability of the brace and non-brace groups and hence the effectiveness of the randomization process.

TABLE 1a

Comparison of Age, Height, Weight, and Physical Fitness for Brace and Control Groups

	Non-Braced mean (SD)	Braced mean (SD)
Mean Age (years)	**23.1** ±5.0	**23.2** ± 5.0
Mean Weight (pounds)	**165.8** ± 19.9	**166.6** ± 20.4
Mean Height (inches)	**69.7**± 2.8	**69.8** ± 2.7
Mean Sit-ups (2 min)	**71.7** ± 12.4	**72.9** ± 13.8
Mean Push-ups (2 min)	**66.2** ± 14.5	**66.0** ± 16.4
Mean 2-mile run time	**13.4 min** ± 1.2 min	**13.4 min** ± 1.2 min

TABLE 1b

Comparison of Gender, Race, Smoking Status, and History of Prior Ankle Injury for Brace and Control Groups

	Non-Braced (%)	Braced (%)
Women %	3.5%	3.8%
Whites	82.0%	77.1%
Blacks	7.9%	12.7%
Hispanics	6.3%	6.9%
Others	3.8%	3.3%
Smokers	22.5%	20.0%
History of prior ankle injury	51.0%	51.0%

The distribution of primary injuries by type and body part is displayed in Table 2. Thirty-five volunteers experienced one or more injuries (4.7 % of all volunteers). Ankle injuries were the predominate injury, accounting for 40.5% of all injuries, followed by contusions, which accounted for 27.0% of the total. Of the ankle injuries, 53% were inversion or lateral anterior talofibular (ATF) sprains, 27% were syndesmosis sprains, and 20% were fractures.

TABLE 2
Distribution of Injuries by Type and Location

Type Injury	Location	Non-Braced n = 376	Braced n = 369	Total n = 745	Percent of All Injuries
Sprains	Ankle- lateral/ATF	7	1	8	21.6
	medial/deltoid	0	0	0	0.0
	syndesmosis	2	2	4	10.8
	Knee	2	0	2	5.4
	Shoulder	1		1	2.7
	Wrist	0	1	1	2.7
Strains	Leg	1	2	3	8.1
	Back	0	1	1	2.7
Fractures	Ankle	1	2	3	8.1
	Foot	0	1	1	2.7
Contusions	Foot	2	1	3	8.1
	Leg	1	4	5	13.5
	Upper Extremities	1	1	2	5.4
Lacerations	Hand	1	0	1	2.7
	Face	0	1	1	2.7
Head Injury		1	0	1	2.7
Total		20	17	37	

*Two individuals each had two injuries

Significantly more ankle sprains occurred in non-brace wearers. Fifteen jumpers (2.2%) of all volunteers experienced ankle injuries. Of these, eight (1.2%) were lateral (inversion) sprains. Incidence and risk ratios for injuries in non-brace vs. brace groups are displayed in Table 3. Only one inversion ankle

sprain (grade 1) occurred in the brace group, compared to seven in the non-brace group (4 grade 1 inversion sprains, 3 grade 2 inversion sprains) (risk ratio was 6.3:1, $p < 0.04$). No significant difference between brace and non-brace groups were evident for any of the other categories of injury.

Table 3
Incidence (%) of Injuries Among Brace and Non-Brace Groups

Injury	Non-Brace	Brace	Risk Ratio	p value
Inversion sprains	1.9%	0.3%	6.3:1	0.04
Ankle syndesmosis sprains	0.5%	0.5%	1.0:1	1.00
All ankle injuries	2.7%	1.4%	2.0:1	0.20
Foot, ankle, leg injuries (excluding contusions)	3.5%	1.9%	1.8:1	0.19
Lower body injuries (excluding ankle injuries and all contusions)	0.8%	0.8%	1.0:1	0.98
Lower body contusions	0.8%	1.4%	0.6:1	0.45
All injuries	5.3%	4.6%	1.2:1	0.65

Subjective survey responses from study participants revealed several perceived strengths, as well as shortcomings of the brace. Of the students who wore the braces, the overwhelming majority (86%) seemed convinced that the braces were effective at reducing their risk of injury. Eight percent (29) of brace wearers felt that they were uncomfortable to wear. Several students did not perceive sufficient risk of injury to warrant the inconvenience of wearing the brace. Two students attributed minor contusions of the shins to the wear of the brace. Twelve students commented that the straps were not durable enough.

DISCUSSION

The outside-the-boot braces prevented lateral/inversion ankle sprains associated with parachute landing, and did not cause other types of injuries. The braces reduced the incidence of ankle sprains by 85%.

In this randomized trial, injury incidence appears to be consistent with the literature that indicates the incidence of injury per jump ranges from 0%-7.9% for mass descents (Lillywhite, 1991). Forty-three percent of the injuries in this study involved the ankle. This is consistent with literature that reports the proportion of ankle injuries in military parachuting to be 30%-60% of total injuries (Davison, 1990).

We found the overall incidence of ankle injuries in this population to be relatively low. This is probably due to several factors. First, the carefully controlled environment of the airborne school, and the strict reliance on well-developed and thoroughly tested safety procedures, as well the recency of the training combine to reduce overall injury rates. Second, ankle braces effectively reduce inversion sprains and half of the study population was wearing braces. The per jump incidence of all types of ankle injuries was 0.4% (0.3% among brace wearers, 0.5% among non-brace wearers). Since each volunteer made five jumps, the cumulative incidence of ankle injuries for volunteers attending airborne school was approximately 2.0% (1.4% among brace wearers, 2.7% among non-brace wearers).

There were no seriously disabling lateral ankle sprains among the brace wearers (one grade 1 inversion sprain). On the other hand, among the non-brace wearers, in addition to four grade one inversion sprains, there were three grade 2 inversion sprains. While an individual with a grade 1 sprain might be capable of completing airborne school, a grade 1 sprain might not allow an individual to carry out a combat mission where maximum agility and load carrying capacity are required. Individuals with grade 2 sprains are even more likely to be seriously disabled. The best operational comparison between the brace group and non-brace group might be of grades 2 and 3 inversion sprains. In this study, despite the relatively low rates of injuries typical during Airborne School, grade 2 inversion sprains among non-brace wearers outnumbered those of brace

wearers 3:0. This finding is consistent with the expectation that these braces will reduce both the frequency and severity of inversion sprains, and that they will reduce operationally important injuries.

While not statistically significant, lower extremity contusions among brace wearers outnumbered those among non-brace wearers 4:1, including one brace wearer with bilateral contusions. Two individuals reported on their surveys that they thought the braces had caused these injuries. None of these contusions were functionally significant. Furthermore, it is likely that these injuries can be prevented by proper fitting and adjustment of the braces or perhaps by additional padding provided around the top of the boot. This is an area worthy of further observation and investigation.

If the reduction in inversion ankle sprains proves to be consistent among all military parachutists, and if the parachute ankle brace gains widespread approval, the reduction in morbidity due to ankle injuries could be substantial. Static-line parachute deployments have been in the range of 200,000-300,000 per year for the past decade. Assuming an incidence rate of 0.4% for disabling inversion ankle injuries, the expected number of such injuries on an annual basis will be between 800-1200. If the ankle braces are only 50% effective, the potential reduction in ankle injuries could be as many as 600 per year Army wide. Injury reductions of this magnitude would have considerable impact on readiness, and would save the government many thousands of dollars per year in lost productivity as well as direct and indirect medical care costs. The reduction in individual soldier's pain and long-term disability, while impossible to quantitative precisely, could be even more significant.

In conclusion, the finding that the outside-the-boot ankle brace prevents ankle sprains is most generalizable to airborne school students, but may be expected to apply to tactical military parachuting as well. While the ankle braces will probably prevent injuries in other military populations, testing is necessary in a wider range of populations under a much broader set of conditions. It will be especially important to test the braces under conditions of low illumination (night-time), heavier combat loads carried, rougher terrain, less favorable weather, different types of parachutes, and low-level exits.

Injuries in parachuting and other operational activities can be prevented or controlled, first, by careful documentation of hazards and risk factors for injury, followed by the creation and testing of appropriate interventions. The parachute ankle brace is a simple device that shows tremendous promise as one element in a larger, more comprehensive Army injury control program.

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Airborne Physical Fitness, Activity & Health Questionnaire

In this questionnaire you will be asked about yourself and your lifestyle. This will include questions about habits, level of exercise, and past injuries. Read each question carefully and answer as accurately as possible. Amswering any or all of the questions is voluntary.

I . GENERAL QUESTIONS

1. NAME:_____ (LAST, FI, MI)

2. UNIT _____ (Bn , Company)

3. GENDER: ☐ MALE ☐ FEMALE

4. SSN: ___ ___ ___ ___ LAST 4

0 1 2 3 4 5 6 7 8 9

5. AGE:__ __

0 1 2 3 4 5 6 7 8 9

6. ETHNIC GROUP

☐ ASIAN
☐ BLACK
☐ HISPANIC
☐ WHITE
☐ OTHER

7. RANK

E 1 2 3 4 5 6 7 8 9
WO
O
CIV

8. YEARS IN SERVICE

0 1 2 3 4 5 6 7 8 9

9. DUTY MOS

0 1 2 3 4 5 6 7 8 9

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

10. WHAT IS THE HIGHEST LEVEL OF EDUCATION YOU HAVE COMPLETED ?

☐ 10TH GRADE OR LESS
☐ 11TH GRADE
☐ GRADUATED FROM HIGH SCHOOL
☐ 1 -3 YEARS OF COLLEGE
☐ GRADUATED FROM COLLEGE
☐ MASTERS DEGREE OR HIGHER

11. AIRBORNE STATUS:

A. HOW MANY JUMPS HAVE YOU COMPLETED ?

___ ___ ___

0 1 2 3 4 5 6 7 8 9

B. LEVEL OF EXPERIENCE ?

☐ AIRBORNE SCHOOL
☐ JUMP MASTER
☐ ALO

PAGE 1 of 5

II. HEALTH HABITS AND CURRENT FITNESS LEVEL

1. WHICH STATEMENT BEST DESCRIBES YOUR SMOKING HABIT IN THE LAST YEAR?

- ☐ I HAVE NEVER BEEN A SMOKER
- ☐ I SMOKED BUT QUIT → ☐ I QUIT LESS THAN 6 MONTHS AGO; ☐ I QUIT 6 MONTHS TO A YEAR AGO; ☐ I QUIT MORE THAN A YEAR AGO
- ☐ I SMOKE 10 OR LESS CIGARETTES/DAY
- ☐ I SMOKE 11 TO 20 CIGARETTES/DAY
- ☐ I SMOKE MORE THAN 20 CIGARETTES/DAY

2. DO YOU CHEW (OR DIP OR PINCH) TOBACCO PRODUCTS?

- ☐ YES
- ☐ NO

3. IF YES ON QUESTION 2, ON AVERAGE HOW OFTEN DO YOU DIP OR CHEW?

- ☐ ONCE OR LESS PER DAY
- ☐ 2-4 TIMES PER DAY
- ☐ 5-10 TIMES PER DAY
- ☐ MORE THAN 10 TIMES PER DAY

4. IF YES ON QUESTION 3, ON AVERAGE HOW MUCH DO YOU DIP OR CHEW?

- ☐ LESS THAN ONE CAN OR POUCH PER MONTH
- ☐ LESS THAN ONE CAN OR POUCH PER WEEK
- ☐ 1-2 CANS OR POUCHES PER WEEK
- ☐ 3 OR MORE CANS OR POUCHES PER WEEK

5. ARMY PHYSICAL FITNESS TEST (APFT)

TO THE BEST OF YOUR RECOLLECTION LIST YOUR MOST RECENT HEIGHT, WEIGHT, AND APFT SCORES

A. WEIGHT (LBS)	B. HEIGHT (INCHES)	C. Number of PUSHUPS	D. Number of SIT UPS	E. 2 MILE RUN MIN	E. 2 MILE RUN SEC	F. TOTAL APFT POINTS
0 1 2 3 4 5 6 7 8 9	0 1 2 3 4 5 6 7 8 9	0 1 2 3 4 5 6 7 8 9	0 1 2 3 4 5 6 7 8 9	0 1 2 3 4 5 6 7 8 9	0 1 2 3 4 5 6 7 8 9	0 1 2 3 4 5 6 7 8 9

III. EXERCISE AND SPORTS IN THE LAST 2 MONTHS

1. RUNNING OR JOGGING TRAINING:

A. How many days per week did you run or jog in the last 2 months on an average basis?

- ☐ None in the last 2 months
- ☐ Less than one day per week
- ☐ 1 - 2 days per week
- ☐ 3 - 4 days per week
- ☐ 5 - 6 days per week
- ☐ 7 days per week

B. On days when you ran or jogged in the last 2 months, how many minutes did you run or jog on an average basis?

- ☐ Did not run or jog
- ☐ 15 minutes or less per day
- ☐ 16 - 30 minutes per day
- ☐ 31 - 45 minutes per day
- ☐ 46 - 60 minutes per day
- ☐ >60 minutes per day

2. WEIGHT TRAINING:

A. How many days per week did you do weight training (free weights, nautilus, etc.) in the last 2 months on an average basis?

- ☐ None in the last 2 months
- ☐ Less than one day per week
- ☐ 1 - 2 days per week
- ☐ 3 - 4 days per week
- ☐ 5 - 6 days per week
- ☐ 7 days per week

B. On days when you did weight training in the last 2 months, how many minutes did you train on an average basis?

- ☐ Did not do weight training
- ☐ 30 minutes or less per day
- ☐ 31 - 60 minutes per day
- ☐ 61 - 90 minutes per day
- ☐ 91 - 120 minutes per day
- ☐ More than 120 minutes per day

3. OTHER EXERCISE OR SPORTS:

A. How many days per week did you exercise or play sports other than running or weight training in the last 2 months on an average basis?

- ☐ None in the last 2 months
- ☐ Less than one day per week
- ☐ 1 - 2 days per week
- ☐ 3 - 4 days per week
- ☐ 5 - 6 days per week
- ☐ 7 days per week

B: On days when you exercised or played sports in the last 2 months, how many minutes were you active on an average basis?

- ☐ Did not do other exercises
- ☐ 30 minutes or less per day
- ☐ 31 - 60 minutes per day
- ☐ 61 - 90 minutes per day
- ☐ 91 - 120 minutes per day
- ☐ More than 120 minutes per day

4. STRETCHING:

How often did you stretch before or after exercise in the last 2 months?

- ☐ None, did not exercise in the last 2 months
- ☐ None, I exercised but did not stretch
- ☐ I stretched less than half the time
- ☐ I stretched about half the time
- ☐ I stretch more than half the time
- ☐ I always stretch when I exercise

5. MARCHING

A. In the last two months, how many times did you march ?

- ☐ None in the last 2 months
- ☐ 1 time
- ☐ 2 times
- ☐ 3 times
- ☐ 4 times
- ☐ 5 times
- ☐ 6 times
- ☐ 7 times
- ☐ 8 or more times

B. In the last two months, when you marched what was the average distance you marched

- ☐ None in the last 2 months
- ☐ 1 - 5 miles
- ☐ 6 - 10 miles
- ☐ 11 - 15 miles
- ☐ 15 - 20 miles
- ☐ more than 20 miles

III. HEALTH AND PAST INJURIES AND ILLNESSES

1. LOST DUTY DAYS:

Have you ever suffered an injury or accident that resulted in your being on profile, limited duty or on quarters (or missed school/work)?

☐ YES
☐ NO

If yes, list the one or two most recent ones and the years.

INJURY	PART	YEAR <82 83 84 85 86 87 88 89 90 91 92+	JUMP RELATED
_____	_____		☐ YES ☐ NO
_____	_____		☐ YES ☐ NO

2. HOSPITALIZATION FOR INJURY:

Have you ever had an injury or accident that caused you to be in the hospital overnight?

☐ YES
☐ NO

If yes, list the one or two most recent ones and the years.

INJURY	PART	YEAR <82 83 84 85 86 87 88 89 90 91 92+	JUMP RELATED
_____	_____		☐ YES ☐ NO
_____	_____		☐ YES ☐ NO

3. HOSPITALIZATION FOR AN ILLNESS:

Have you ever had an illness that caused you to be in the hospital overnight?

☐ YES
☐ NO

If yes, list the one or two most recent ones and the years.

INJURY	PART	YEAR <82 83 84 85 86 87 88 89 90 91 92+	JUMP RELATED
_____	_____		☐ YES ☐ NO
_____	_____		☐ YES ☐ NO

4. HEAT OR COLD INJURY:

Have you ever suffered a heat or cold injury?

☐ NO
☐ YES, HEAT
☐ YES, COLD
☐ YES, BOTH

If yes, list the one or two most recent ones and the years.

	INJURY	YEAR <82 83 84 85 86 87 88 89 90 91 92+
HEAT	_____	
	_____	
COLD	_____	
	_____	

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IV. MISCELLANEOUS QUESTIONS

1. FEET:

How would you classify your feet?

- ☐ Flat
- ☐ High Arches
- ☐ Normal

2. KNEES:

How would you classify your knees?

- ☐ Knocked knees
- ☐ Bowed legged
- ☐ Normal

3. WHICH HAND DO YOU WRITE WITH ?

- ☐ Right
- ☐ Left
- ☐ Both

4. WHICH HAND DO YOU THROW A BALL WITH ?

- ☐ Right
- ☐ Left
- ☐ Both

5. WHICH FOOT DO YOU KICK A BALL WITH ?

- ☐ Right
- ☐ Left
- ☐ Both

6. SPRAINED ANKLES:

Have you ever had a sprained ankle that limited your ability to run or walk?

- ☐ No
- ☐ Yes

If yes, what ankle(s) (right or left) and the ONE year you last sprained your ankle(s).

☐ RIGHT ANKLE

YEAR

before 70	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

☐ LEFT ANKLE

YEAR

before 70	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

0692b

Airborne Post-Jump Questionnaire

In this questionnaire you will be asked for information about the conditions of the jump you just performed and any troubles you might have experienced.

I. Background

1. NAME:_____ (LAST, FI, MI) 2. SSN: ____ LAST 4

Do Not Use

3. SUBJECT # _____

II. Jump Information

1. Today's date (date of this jump) ___/___/___ (mo/day/year)

2. Which jump was this (#) ? ☐ 1st ☐ 2nd ☐ 3rd ☐ 4th ☐ 5th

3. What type of jump was it ?
   - ☐ Day, Hollywood
   - ☐ Day, Combat equipment
   - ☐ Night, Hollywood
   - ☐ Night, Combat equipment

4. From what type of aircraft did you jump ?
   - ☐ C-130
   - ☐ C-141B
   - ☐ Other _____ (specify)

5. From what door did you exit the aircraft ?
   - ☐ Right
   - ☐ Left

6. How long did you have all your equipment on and checked (JMPI) prior to boarding the aircraft?
   - ☐ 0-30 minutes
   - ☐ 31-60 minutes
   - ☐ 61-90 minutes
   - ☐ 91-120 min
   - ☐ >120 min

7. How long were you in the aircraft prior to takeoff ?
   - ☐ 0-30 minutes
   - ☐ 31-60 minutes
   - ☐ 61-90 minutes
   - ☐ 91-120 min
   - ☐ >120 min

8. How long was the time between takeoff and your exit from the aircraft ?
   - ☐ 0-30 minutes
   - ☐ 31-60 minutes
   - ☐ 61-90 minutes
   - ☐ 91-120 min
   - ☐ >120 min

9. Did you experience any of the following difficulties ?
   - ☐ Difficult Exit
   - ☐ Interference (other jumper)
   - ☐ Dragged on ground by chute
   - ☐ Did not experience any difficulties
   - ☐ Twisted risers
   - ☐ Entanglement (other jumper)
   - ☐ Other _____ (specify)
   - ☐ Chute malfunction
   - ☐ Deployed reserve

Explain all difficulties in as much detail as possible

_____

_____

_____

2

10458

II. Jump Information (contd.)

10. If you carried equipment, did you ride it in/not release it prior to landing ?

☐ yes ☐ no ☐ not applicable

11. On a scale of one to five, rate how well you could see objects the drop zone just prior to landing:

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

(very poorly) (very well)

12. Did your direction of drift change just prior to landing ? ☐ yes ☐ no

If yes , what was the reason ?

☐ pulled a slip to head into the wind
☐ pulled a slip to avoid another jumper
☐ Other _____ (specify)
☐ pulled a slip to avoid an obstacle
☐ experienced a sudden crosswind

13. Did you execute a proper PLF ? ☐ yes ☐ no

14. What PLF did you use ?

☐ Right ☐ Front
☐ Left ☐ Rear

15. What PLF do you prefer to use ?

☐ Right ☐ Front ☐ No preference
☐ Left ☐ Rear

16. Did you encounter any hazards on this jump ? ☐ yes ☐ no

If yes , please explain all hazards in detail.

_____

_____

17. What type of surface did you land on (grass, sand, trees, etc.) ? _____

18. Have you been assgned to wear an ankle brace ? ☐ yes ☐ no

19. If you answered yes on question 19, did you wear the ankle brace on this jump ? if not, please explain why. ☐ yes ☐ no

_____ (explain)

0892 Airborne Injury Follow-up and Ankle Brace Acceptability Questionnaire

In this questionnaire you will be asked for information about any injuries you experienced during Airborne School and any opinions you may have about the ankle brace .

I. Background

1. NAME:_____ (LAST, FI, MI) 2. SSN: _ _ _ _ _ _ _ _ _ **Do Not Use** 3. SUBJECT # _ _ _ _ _ _ _

II. Injuries

1. Did you sustain ANY injuries during Jump week ? ☐ yes ☐ no

If you answered yes , please provide the following information for the TWO most severe injuries

INJURY # 1

A. On what jump did your first injury occur ? ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ NA

B. Please give the following information about that injury:

_____ _____ ☐ Right ☐ Left ☐ NA

Injury type (sprain, bruise, etc) **Body Part (knee, ankle, etc)** **Side**

c. What caused the injury in your opinion ?

_____

INJURY # 2

A. On what jump did your second injury occur ? ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ NA

B. Please give the following information about that injury:

_____ _____ ☐ Right ☐ Left ☐ NA

Injury type (sprain, bruise, etc) **Body Part (knee, ankle, etc)** **Side**

c. What caused the injury in your opinion ?

_____

2. During other weeks of training did you sustain any other injuries ? ☐ yes ☐ no

A. During which week did the injury(ies) occur ? ☐ ground ☐ tower

B. Please give the following information about the most serious injury:

_____ _____ ☐ Right ☐ Left ☐ NA

Injury type (sprain, bruise, etc) **Body Part (knee, ankle, etc)** **Side**

c. What caused the injury in your opinion ?

_____

III. Ankle Brace Questions

1. At the beginning of this study, did you want to wear an ankle brace ? ☐ yes ☐ no

2. Did you wear an ankle brace as part of this study ? ☐ yes ☐ no

If you answered yes to question #2, please answer question 3 thru 10, If you did not wear the brace please answer question 10 only.

3. Did you practice your PLFs wearing an ankle brace ? ☐ yes ☐ no

4. Prior to jumping, did you think the brace would protect you from injury ? ☐ yes ☐ no

5. In your opinion did the brace protect you from injury ? ☐ yes ☐ no

If yes, mark the jump(s) on which you feel the brace protected you from injury, and please explain why you feel that way.

Protected from injury on jump # ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

explain: _____

6. Was the brace uncomfortable to wear on any of your jumps ? ☐ yes ☐ no

7. Did the brace ever change your PLF ? ☐ yes ☐ no

If yes, how? _____

8. What criticism(s) do you have concerning the ankle brace ?

☐ No criticism(s), I like the brace as it is.
☐ I have the following criticisms: _____
_____

9. Would you wear the brace again ? ☐ yes ☐ no

10. Please list any other comments or criticisms you have about the brace or this study

_____
_____
_____
_____

APPENDIX D 1

APPENDIX D 4

Injuries Among Individuals

Brace Group

1	fracture of the 2nd - 4th metatarsals of the left foot
2	bimalleolar fracture of the left ankle grade 3 syndesmosis sprain of the left ankle
3	fracture of the right posterior malleolus metatarsal contusion of he right foot
4	facial laceration (lip)
5	grade 1 syndesmosis sprain of the right ankle
6	contusion of the right leg (mid-distal third)
7	contusion of the right proximal tibia
8	grade 1 acromioclavicular sprain of the left shoulder contusion of the left arm
9	grade 1 anterior talofibular sprain of the left ankle
*10	contusion of the left leg contusion of the right leg
11	grade 1 strain of the right posterior tibial tendon
12	grade 1 strain of the anterior leg muscles
13	lumbar strain
14	grade 1 syndesmosis sprain of the right ankle
15	contusion of the 2nd - 5th metatarsal-phalangeal joints of the left foot
16	contusion of the right elbow

*counted as two seperate injuries in analysis

Injuries Among Individuals

Non-Brace Group

1	fracture of the posterior malleolus of the right ankle with grade 3 syndesmosis, grade 3 anterior talofibular, and grade 3 deltoid sprains
2	grade 2 syndesmosis sprain of the right ankle with grade 1 deltoid sprain (and old medial malleolar avulsion chip fracture)
3	contusion of the right foot
4	closed head injury
5	fracture of the right fibula with grade 3 syndesmosis sprain and grade 3 deltoid sprain of the right ankle
6	grade 1 sprain of the anterior talofibular ligaments of the right ankle
7	grade 1 sprain of the anterior talofibular ligaments of the right ankle
8	grade 1 strain right posterior tibial tendon
9	contusion left leg
10	laceration of the right finger
11	grade 2 sprain of the anterior talofibular ligament of the left ankle
12	grade 1 sprain of the anterior talofibular ligament of the right ankle
*13	grade 1 sprain of the anterior talofibular ligament of the right ankle grade 1 sprain of the lateral collateral ligament of the right knee
14	grade 1 sprain of the medial collateral ligament of the right knee
15	left wrist sprain
16	contusion of the soft tissue over the 3rd - 4th metatarsals, right foot
17	contusion of the right hand
18	grade 2 sprain of the anterior talofibular ligament of the left ankle
19	grade 2 sprain of the anterior talofibular ligament of the right ankle

*counted as two separate injuries in analysis

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