Effect of the Swede-O Ankle Brace on Talar Tilt in Subjects With Unstable Ankles

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Abstract:
This study examined the effect of the Swede-O ankle brace on talar tilt in subjects with unstable ankle joints. Six college-age females with talar tilts greater than 9.5° at 15 decaNewtons (daN) of force on a Telos stress test device participated in the study. Each subject was X-rayed at five levels of force (0, 6, 9, 12, and 15 daN), first with a bare ankle then wearing a Swede-O ankle brace. A two-factor (Brace x Force) analysis of variance revcaled a main effect for force, but no main effect for brace and no Brace x Force interaction. For the unbraced ankles, mean displacements were 8.2, 10.4, 11.9, and 13.1° at the four levels of force, respectively. After application of the bracc, the talar tilts were 5.7, 8.5, 11.1, and 12.8°, respectively. These findings suggest that the Swede-O ankle brace was not effective in reducing talar tilt in subjects with unstable ankles. Any efficacy of the brace may be due to other factors, such as proprioceptive feedback during inversion.

Article:
The ankle sprain is a common athletic injury and accounts for 15% of all injuries sustained in either athletic competition or physical training (5). Of these sprains, 85% are of the inversion mechanism (5, 8, 14, 17, 21, 23). The majority of these sprains respond well to conservative treatment including icing, elastic bandage, short-leg cast, or pneumatic brace. However, 20 to 40% of patients seek further medical attention for persistent swelling and pain, a sense of instability, particularly when walking or running on uneven ground, and repeated inversions.

Prophylactic ankle taping has been shown to restrict motion in and around the ankle joint (l, 3, 7, 9, 11, 13-16, 23, 24). Numerous studies have examined the effect of ankle braces, including the Swede-O ankle brace, on range of motion at the ankle joint (l, 2, 7-10, 16, 24). These studies have covered a wide variety of topics ranging from the amount of support provided to effects on athletic performance. None of the studies, however, used subjects whose ankles were judged to be unstable.

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Several methods exist to measure the efficacy of taping or bracing in limiting excessive motion of the ankle joint and include standard goniometry or some similar device (1, 4, 8-11, 15, 16, 23, 24). The goniometer gives an accurate measurement of joint range of motion, but quantification of the amount of stress between and within apparatus and examiner is impossible. Manual inversion stress X rays have the same shortcoming. Standardization of the amount of stress between examiners and between apparatuses is impossible, as the amount of stress placed on the ankle is highly examiner dependent.

The commercially available Telos stress device, used in combination with low-intensity X rays, has been designed to alleviate these shortcomings by reproducibly mounting the ankle and quantifying the force applied to the ankle joint. Talar tilt angles at known forces can be reliably determined and used to assess the amount of ligamentous disruption in ankle-injured patients (17-19).

The purpose of this study was to determine the efficacy of the Swede-O ankle brace in preventing inversion in subjects with history of injury to the ankle using the Telos stress device.

METHODS AND PROCEDURES

Subjects

The subjects for this study were 6 female college students (age = 25.4 years, height = 163.l cm, weight = 63.5 kg) with a prior history of inversion ankle trauma, or known ankle laxity. All subjects volunteered for participation in this study, and each was informed of the nature, purpose, and possible risks of the research. An informed consent release was read and signed by each subject.

Instrumentation and Supplies

A Telos GA-II/E stress device (Austin & Associates, Inc., Fallston, MD) was used to measure the talar tilt angle. The device is equipped with a screw- threaded shaft that permits stress to be applied gradually (17-19). The amount of force is monitored on a light-emitting, diode digital readout. Anterior- posterior X rays were taken after application of 0, 6, 9, 12, and 15 decaNewton (daN) of force.

The Swede-O ankle support (Swede-O Universal, North Branch, MN), which was used to support the ankle, is a lace-up ankle brace made of a canvas material covered by vinyl. The brace is worn between the sock and the shoe.

Procedures

To determine eligibility to participate in the study, a preliminary stress X ray was taken of the involved ankle at 15 daN. An unstable ankle was defined for the purposes of this study as a talar tilt of at least 10° at 15 daN. If the subject qualified for the study then an initial set of stress X rays were taken at 0, 6, 9,

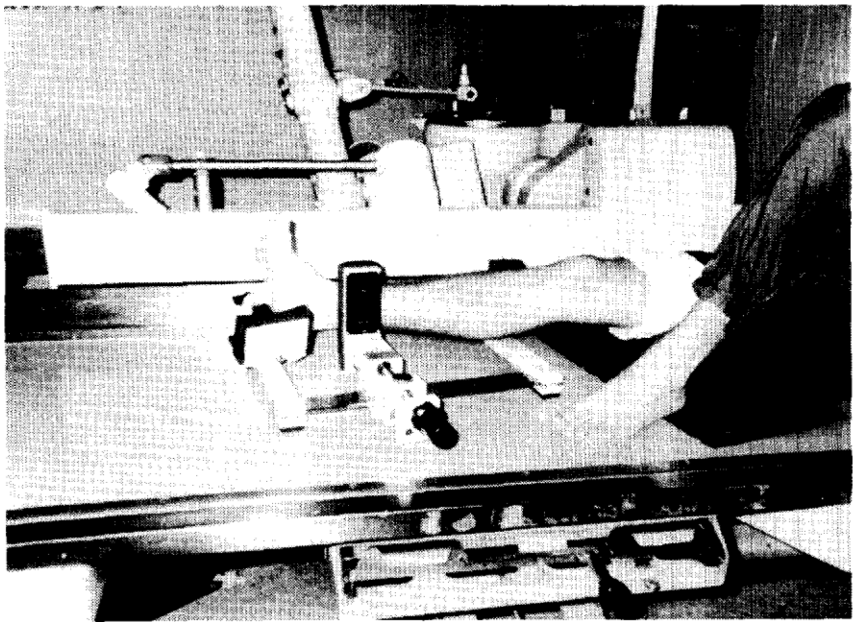

Figure 1— Telos inversion stress test of unbraced ankle.

12, and 15 daN to obtain baseline measurements of talar tilt without the wearing of the ankle brace (Figure l). A second set of stress X rays were taken with the Swede-O ankle brace (Figure 2) applied according to the manufacturer's instructions. The second set of X rays were taken to determine the amount of restriction provided by the Swede-O ankle brace.

Statistical Analysis

Mean talar tilt displacements were recorded at each of the five settings with the ankle bare and with the ankle brace applied. A two-factor (Brace x Force) analysis of variance with four repeated measures on force level was computed to determine if differences in displacement existed between the braced and unbraced conditions.

RESULTS AND DISCUSSION

The mean (± standard deviation) talar tilt values at 0, 6, 9, 12, and 15 daN for the unbraced and braced ankles are listed in Table 1. The analysis of variance revealed a main effect for force, $F(3, 15) = 34.84$, $p < .001$. No main effect was found for brace, $F(l, 5) = 1.07$, $p = .348$, and no brace-by-force interaction was found, $F(3, 15) = 2.43$, $p = .105$.

The major finding of this study was that the Swede-O ankle brace was not

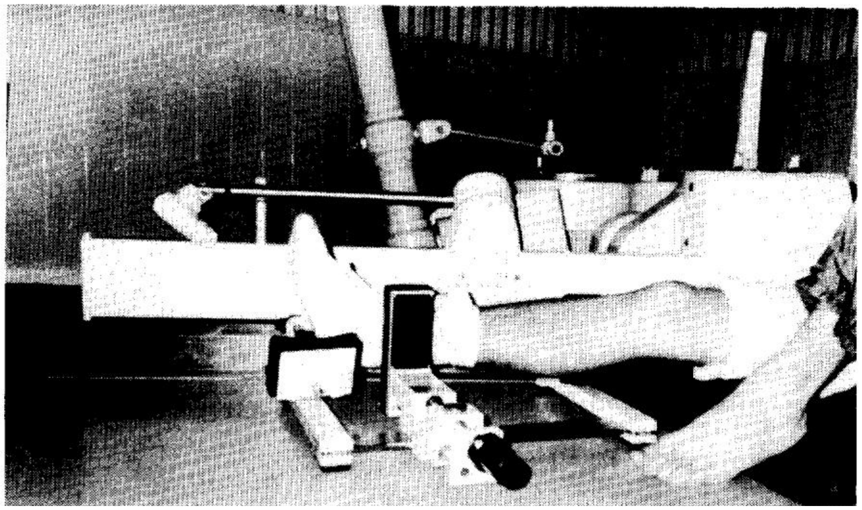

Figure 2 — Telos inversion stress test of braced ankle.

Table 1
Angles of Talar Tilt (in degrees) for Unbraced and Braced Ankles
Measured at Four Different Force Levels

Force level (daN)	Unbraced *M*	Unbraced *SD*	Braced *M*	Braced *SD*
6	8.2	4.3	5.7	2.3
9	10.4	4.3	8.5	3.3
12	11.9	4.5	11.1	4.0
15	13.1	4.0	12.8	4.9

effective in limiting talar tilt. A trend toward some limitation in motion seemed to exist at the lower force. However, in all probability the forces required to sprain an ankle exceed 6 or 9 daN of force. As such, the ankle brace used in this study appears to be inadequate in preventing the talar tilt associated with inversion ankle sprain.

Previous studies have shown that the Swede-0 ankle brace is effective in preventing subtalar joint displacement (l, 2, 7-9). However, these studies all concerned subjects who had no previous history of ankle trauma, or no history of trauma within the 6 months prior to the study. This renders a comparison of our findings with these studies difficult.

The findings of our study appear to question the efficacy of the ankle brace in preventing recurrence of inversion sprains. Rovere et al. (20) found that ankle braces decreased the incidence of injury to the uninjured ankle. Their findings seem to suggest that mechanisms other than limitation of talar tilt may prevail in decreasing the rate of ankle sprain. Many clinicians attribute the value of ankle taping or bracing to enhanced proprioceptive feedback relative to the position of the ankle in space. Limitation of the talar tilt angle up to 6 daN of force might indeed be adequate in facilitating a proprioceptive feedback mechanism. The existence of this potential mechanism might also explain the results of Rovere et al. (20) and the positive reaction of many ankle-injured athletes to either the application of tape or the wearing of braces. Further research is needed to determine the effect of ankle bracing and taping on joint proprioception.

A possible limitation of our study is that the order of stress X ray was not randomized. That is, all subjects underwent examination at 0, 6, 9, 12, and 15 daN of force first with no brace and then with the brace applied to the unstable ankle. In an unstable ankle, the anterior talo-fibular ligament is completely ruptured and the calcaneal fibular ligament is either partially or completely torn as well (17-19). Consequently, the connective tissues in and around the ankle (skin, fascia, tendons) serve more prominently to provide support to the unstable joint. Our examination procedure thus had the potential to "stretch out" the nonligamentous supporting structures about the ankle joint. Future research should consider randomizing both the unbraced and braced status of the ankle as well as the range of pressures applied by the Telos stress device.

An interesting finding in our study was that although we did not have difficulty identifying athletes with a history of significant ankle sprain, only a small number of these athletes qualified for the study with respect to ankle instability. Virtually all participants had undergone an aggressive program of rehabilitation. The fact that several did not exhibit markedly unstable ankles would seem to support the value of therapeutic exercise as well as the potential role of the aforementioned nonligamentous tissue structures.

In summary, this study found no limitation of the talar tilt angle when subjects wore the Swede-0 ankle brace. For future research, a greater number of subjects is indicated as well as randomization of the Telos streSS test procedure with respect to braced and unbraced conditions and to the range of forces applied to the unstable ankle. Finally, future research should examine the role of ankle bracing on joint proprioception.

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