Grant Information Summary:

Ankle Braces Increase Ankle Rotational Stiffness Without Enhancing Leg EMG Activity

Practical Significance:

While ankle braces significantly increased the inversion/eversion rotational stiffness of the ankle, they did not enhance the neuromuscular response to a perturbation. The increase in stiffness has positive implications on joint protection; however, these data imply that the protection comes from the mechanical properties of the brace and not a physiologic change to the ankle system.

Background

For decades clinicians have successfully used ankle braces to reduce the incidence and severity of ankle injuries. Previous research has investigated the effects of ankle bracing on many neuromuscular variables, such as joint position sense, postural sway, and reflex activation with mixed results. Similar research on other joints has pointed to muscle stiffness as a viable prophylactic mechanism. From a mechanical perspective, stiffness describes the ratio of force response of a material to an imposed change in length. Stiffness describes the force of the musculoskeletal system that resists mechanical stretch perturbation. This resistance reduces joint translation, minimizing ligamentous strain and subsequent injury. Thus, control of ankle muscle stiffness may be a primary mechanism by which braces minimize injury.

Objective

To determine the effects of bracing on factors that influence ankle stability in subjects with functionally unstable ankles and healthy controls.

Design and Setting

Repeated measures with each subject evaluated for rotational ankle stiffness and EMG activation with no-brace, lace-up brace, and a semi-rigid brace. All testing was completed in the motion analysis laboratory

Subjects

Twenty-eight subjects with healthy ankles (n = 14, 26.19 ± 6.46 yrs, 166.07 ± 12.90 cm, 69.90 ± 13.46 kg), or unilateral ankle instability (n = 14, 23.76 ± 5.82 yrs, 174.00 ± 11.67 cm, 68.0 ± 13.12 kg)

Measurements

Ankle rotational stiffness was calculated by measuring the natural frequency (w) and decay (ß) of a transient oscillation perturbation. In addition, EMG activation (preactivation, reflex timing and amplitude) of the peroneus longus, peroneus brevis, tibialis anterior, and soleus muscles was measured via surface electromyography.

Results

Rotational stiffness increased significantly from no-brace to lace-up brace and to semi-rigid brace (Figure 1). No stiffness differences were found between stability groups. Braces had no effect on preactivation and reflex timing, and caused a decrease in reflex amplitude (Table 1).

Conclusions

In this study, ankle braces caused an increase in the rotational stiffness of the ankle. Lack of significant influences on EMG activity however, imply that the only contribution of ankle braces to the biomechanical stability of the ankle is passive in nature.

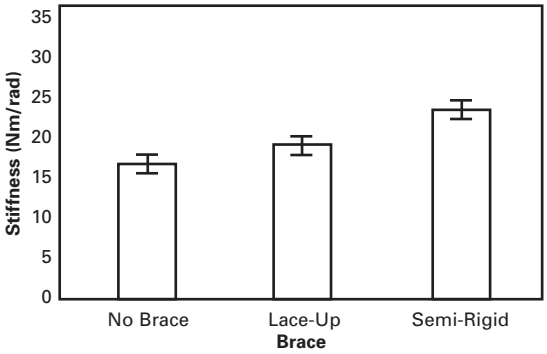

Figure 1. Effect of brace condition on rotational ankle stiffness

Table 1: EMG means and standard deviations

	Preactivation (% MVIC)				Reflex Timing (ms)				Reflex Amplitude (% MVIC)			
	Peroneus Longus		Peroneus Brevis		Peroneus Longus		Peroneus Brevis		Peroneus Longus		Peroneus Brevis	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
No Brace	2.96	6.07	2.64	4.95	92.40	13.61	89.48	11.59	56.20	39.06	107.4	73.27
Lace-Up Brace	2.70	6.13	2.29	4.97	94.53	18.10	94.08	18.82	47.76	43.97	73.81	57.27
Semi-Rigid Brace	2.50	5.94	2.91	5.12	90.24	12.42	91.79	14.19	27.17	23.96	55.23	49.24

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