Grant Information Summary:

Neuromuscular Inhibition of the Dynamic Ankle Stabilizers in Patients with Functional Ankle Instability (FAI)

Practical Significance Statement

Peroneal muscle inhibition is present in patients suffering from functional ankle instability, but this weakness is not related to dynamic ankle instability. Additionally, interventions aimed at minimizing muscle inhibition may not assist in protecting the ankle from further episodes of instability.

Study Background

Functional ankle instability (FAI) may be prevalent in as many as 40% of patients following an acute lateral ankle sprain. Diminished afference resulting from damaged mechanoreceptors after an ankle sprain may lead to reflex inhibition of surrounding joint musculature. This weakness, referred to as arthrogenic muscle inhibition (AMI), maybe the underlying cause of FAI. Incomplete peroneal activation could prevent adequate control of the ankle joint leading to repeated episodes of instability.

Objective

To establish if peroneal muscle inhibition is related to diminished dynamic ankle restraint characteristics in patients with FAI.

Design And Setting

A 2 x 2 factorial design was used to compare limbs (affected and unaffected) between groups (FAI and control). This study was conducted in the Neuromuscular Research Laboratory at The University of Michigan.

Subjects

Twenty-one (18F, 3M) subjects with unilateral FAI (Age = 21± 2 yrs, Height = 171 ± 7 cm, Weight = 65 ± 9 kg) and 21 (18F, 3M) matched controls (Age = 21± 3 yrs, Height = 169 ± 9 cm, Weight = 64 ± 10 kg) volunteered to participate.

Measurements

To establish the presence of muscle inhibition, bilateral peroneal H:M recruitment curves were obtained via stimulation of the sciatic nerve just prior to its bifurcation into the tibial and common peroneal nerves in the popliteal fossa. The maximum H reflex and M wave were extracted and the H:M ratios were calculated. To gather dynamic response characteristics, subjects were asked to walk the length of an 8.5 m runway 25 times. A trap door mechanism was released upon heel contact of six randomly assigned trials for each leg (Figure 1). Subjects walked to the beat of a metronome and wore goggles which blocked their inferior field of view. An electromagnetic switch marked the release of the trap door. Custom software, verified by visual inspection, identified the peroneal muscle onset, which was used to calculate reaction time and normalized RMS EMG for the 100 ms following onset of muscle activity.

Results

FAI subjects had smaller peroneal H:M ratios in their pathological ankle (.323±.161) compared to their non-pathological ankle (.399±.185) (P=.036), while no differences were noted between the ankles of the controls (.442±.176 and .425±.180) (Figure 2). FAI subjects also exhibited significantly higher latency and lower EMG in their pathological ankle (Lat = 106.6±48.7; EMG = 1.7±1.3) compared to their uninjured ankle (Lat = 74.3±23.3; EMG = 3.3±3.1) (P<0.001), while no differences between legs were noted for controls (P>0.05). No significant correlations were found between the peroneal H:M ratio and the measures of dynamic instability (P>0.05).

Conclusions

Our data suggest that peroneal muscle inhibition is present in patients with functional ankle instability. No relationship could be established between the lingering inhibition and dynamic ankle function. Thus, interventions focused on reversing peroneal muscle inhibition may not assist in protecting the ankle from further episodes of instability.

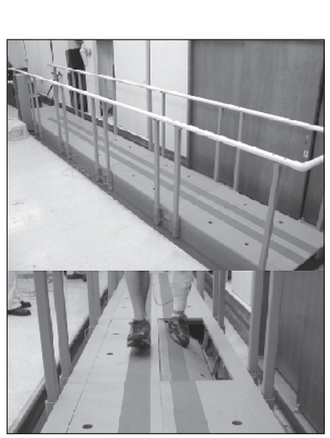


Figure 1. Ankle Inversion Runway

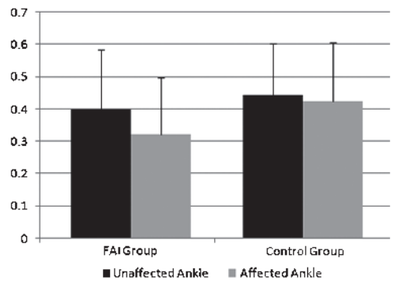


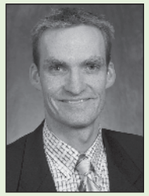
Figure 2. Peroneal H:M ratios for the FAI and Control groups.

Principal Investigator:

Riann Palmieri-Smith, PhD, ATC

Dr. Palmieri-Smith is an Assistant Professor in Athletic Training, Movement Science, and Orthopaedics at the University of Michigan, as well as the director of the Neuromuscular Research Laboratory and co-director of the Human Neuromechanics Laboratory and Injury Biomechanics Laboratory at U of M. Additionally, Palmieri-Smith serves as a Section Editor for Sports Health: A Multidisciplinary Approach and is a guest reviewer for 15 other peer-reviewed journals.

J. Ty Hopkins, PhD, ATC, FACSM



Ty Hopkins is currently an associate professor at Brigham Young University, where he coordinates the graduate programs in athletic training and physical medicine and rehabilitation. Dr. Hopkins graduated from Brigham Young University with a BS in athletic training. The focus of Dr. Hopkins' research centers on prevention and rehabilitation of lower extremity joint injury. He serves as a section editor for the Journal of Athletic Training, and he serves as a reviewer with many other journals and granting agencies.

Publication & Presentation List

Palmieri-Smith RM, Hopkins JT. Dynamic Instability in Patients with Functional Ankle Instability. 2008. National Athletic Trainers' Association Annual Meeting & Clinical Symposium St. Louis, MO.

Palmieri-Smith RM, Hopkins JT. Neuromuscular Dysfunction in Persons with Functional Ankle Instability. 2008. 2nd World Congress on Sports Injury Prevention, Tromso, Norway.

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