THE ACUTE EFFECTS OF CHRONIC TREKKING POLE USE ON STATIC AND DYNAMIC BALANCE

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INTRODUCTION

Hiking is a fast growing recreational activity, but there are inherent risks involved with hiking outdoors. Boulware et al. (2003) determined musculo-skeletal injuries to be the most common type of injury suffered while hiking. A typical way to suffer such an injury would be through a loss of balance. Hence, many hikers have adopted the use of trekking poles due to the unpredictable terrain that is encountered on many trails. Pole use allows for an increase in the base of support, and thus an increase in overall stability (Jacobson, et al., 1997).

The International Mountaineering and Climbing Federation (UIAA) suggests continuous pole use has an adverse effect on acute balance.

> "Continuous use of hiking sticks can decrease the hiker's coordination ability and through this his steadiness, although, in his own mind, he may feel safer. This disadvantage is becoming more and more evident and can lead to certain balancing problems, especially in difficult mountain areas, where stick users cannot use his hiking sticks (i.e. narrow ridges or climbing terrain). In fact, the most common type of hiking accident, the fall by tripping or stumbling, can actually be made a greater risk as a result. For these reasons such accidents occur even during the use of sticks." (UIAA, 1994).

In other words, if a person is out on a hike and are using trekking poles, when they come to a situation where they must put the poles away, their balance may be worse than if they had not used poles at all. The purpose of this study was to examine the effects of continuous hiking pole use on acute static and dynamic balance in experienced hikers.

METHODS AND PROCEDURES

Ten active, female participants with experience using trekking poles while hiking were recruited (ages 21-62). Boulware (2004) noted that women backpackers did not experience significantly more musculo-skeletal injuries than men; therefore the use of women only should still allow for generalization. Approval was obtained from the University IRB and participants signed informed consents. An Aeromat foam pad was used for the Balance Error Scoring System (BESS) static balancing task. The 4-camera Falcon Motion Analysis System was used to collect kinematic data during the dynamic balancing task, using a simulated 3.3m log that participants walked across (60 Hz; filtered at 6 Hz). Knee angles of both legs, stride length and time, right and left arm elevation, and medial/lateral and vertical trunk motion were analyzed. EMG was used to record the erector spinae (ES), bicep femoris (BF), vastus lateralis (VL), tibialis anterior (TA), and the gastrocnemius (GA) (Bortec Inc.; 1000 Hz; rectified, and filtered at 4 Hz).

Walkers participated in both the poles and no poles condition. Participants first performed baseline static and dynamic balance tasks. Then each participant walked for 15 minutes with or without trekking poles (counter-balanced) to achieve a steady state pace, hiking both up and down a 20 degree ramp, before repeating the balancing tasks. Immediately before each balancing task, they were required to set down the poles, if in use, and perform the task as though they had come to a log or narrow ridge on a hike and had to put away the poles to maximize they safety while crossing. Five trials of each balancing task were completed, while continuing to walk with or without poles between each trial. Repeated measures ANOVAs were used to examine statistical sig. (alpha = 0.05).

RESULTS AND DISCUSSION

Results showed fewer errors on average in the pole condition for the static balance task, though not statistically significant (p=0.7). Significantly greater knee flexion was noted in the pole condition (p=0.03) (Figure 1).

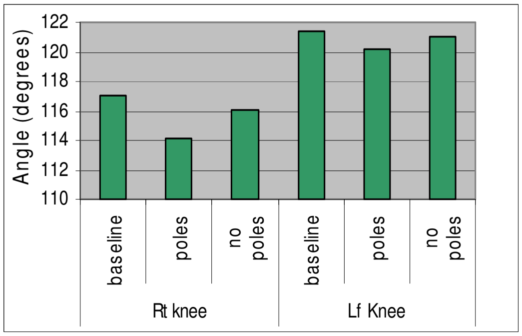

Figure 1. Knee joint flexion angles for the dynamic balance task.

A greater stride length was noted in the pole condition, though not significant (p=0.2). Significantly faster stride times were found in the pole condition compared to the baseline condition (p<.01). No significant differences were seen in arm elevation or trunk sway between pole conditions. The greatest overall muscle activity was elicited in the baseline condition, and the least activity was seen in the pole condition, although no statistically significant differences were noted (p=.4) (Figure 2).

A decrease in stride time and knee flexion angles suggest that the participants had an increased sense of stability because they were more comfortable spending less time in the double support phase of the gait cycle. The lower amount of muscle activity in the pole condition may also indicate an increased sense of stability after pole use, and less need for the individual to use muscular force and co-contraction in order to maintain stability.

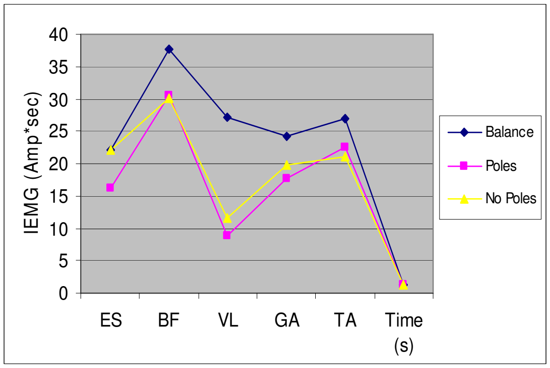

Figure 2. IEMG activity during the dynamic balance task.

SUMMARY

The primary implication of this study was for hiker safety. UIAA suggested that trekking pole use could lead to injury while hiking. The two primary reasons hikers use trekking poles are to increase stability while hiking by increasing their base of support and to lessen the forces placed on the lower extremity joints (Bohne & Abendroth-Smith, 2007). Because no statistical significance was found in this study to show that trekking pole use has a negative effect on subsequent balance tasks, it is suggested that hikers should continue to use trekking poles while hiking to increase stability and lessen the forces placed on the lower extremity.

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