



**Grant Information Summary:**

**The Effect of a 4-Week Balance Training Program on Postural Control and Gait Performance in Those with Chronic Ankle Instability**

**Practical Significance Statement**

**This study demonstrated that participation in 4 weeks of progressive, dynamic balance training significantly improves postural control, gait, and self-reported function in those with chronic ankle instability.**

**Study Background**

Ankle sprains are one of the most common injuries in the physically active population. Recurrent ankle sprains and the consequent feeling of the ankle "giving way" is known as chronic ankle instability (CAI). There have been several contributing factors identified associated with CAI including altered postural control gait mechanics. Balance training has been purported to improve functional outcomes in those with CAI, however there is limited evidence regarding the mechanisms of improvement.

**Objective**

To investigate the effect of a 4-week balance training program among individuals with CAI on: 1) self-reported function as measured by the Foot and Ankle Disability Index (FADI) and FADI Sport, 2) postural control, and 3) walking and jogging gait parameters.

**Design And Setting**

This was a randomized controlled trial performed in the Exercise and Sport Injury Laboratory and the Gait and Motion Laboratory at the University of

Virginia. There were two independent variables, group (balance training, control) and time (pretest, posttest).

**Subjects**

Thirty-one subjects with CAI were randomized into a balance training group (6 males and 10 females: mean age: 22.2±4.5 years, height: 168.9±7.7 cm, mass: 63.0±8.8 kg, 6.3±7.1 previous ankle sprains) and a control group (6 males and 9 females: mean age: 19.5±1.2 years, height: 173.1cm, mass: 67.3 kg, 4.6±2.5 previous ankle sprains).

**Measurements**

All subjects were tested twice separated by five weeks. Self-reported function was evaluated using the Foot and Ankle Disability Index (FADI) and the FADI Sport scales. For static postural control measures, Time-to-boundary measures of center of pressure excursions, including the mean of time-to-boundary minima (magnitude of time-to-boundary measures) and the standard deviation of time-to-boundary minima (variability of time-to-boundary measures) were calculated in the anteroposterior and mediolateral directions during single limb stance. For dynamic postural control measures, reach distances of the Star Excursion Balance Test were measured in the anterior, posteromedial, and posterolateral directions. Walking and jogging gait parameters assessed included rearfoot inversion/eversion, shank internal/external rotation, and their coupling relationship throughout the gait cycle, which consisted of both stance and swing phases.

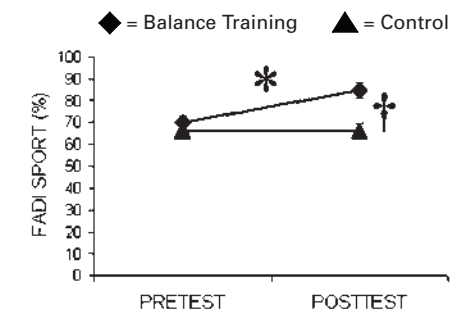
**Results**

The balance training group demonstrated significant improvements in self-reported function, time-to-boundary magnitude and variability in the anteroposterior and mediolateral directions, and the posteromedial and posterolateral reach distances with the Star Excursion Balance Test after 4 weeks of training compared to the control group measures. Significant alterations in rearfoot and shank rotation in walking and jogging compared to their pretest measures were noted in the balance training group at posttest during both the stance and swing phases of gait. The main finding from the gait parameters was a signifi-

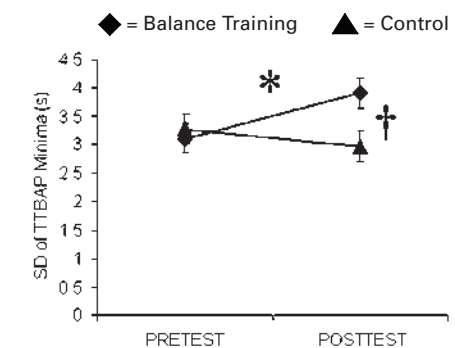
cant reduction in the variability of the shank/rearfoot coupling relationship in the balance training group at posttest compared to pretest measures and the posttest measures of the control group. No such changes were noted in the control group.

**Conclusions**

Balance training significantly improves self-reported function, postural control, and select lower extremity joint kinematics during walking and jogging gait in participants whose suffer from CAI.



**Figure 1:** Means (± standard error) on the Foot and Ankle Disability Index (FADI) Sport group by time interaction. \* P<0.05 for pretest to posttest comparisons within the balance training group. † P<0.05 for between group comparisons at posttest.



**Figure 2:** Means (± standard error) for standard deviation of the time-to-boundary (TTB) minima in the anteroposterior direction (AP) group by side interaction. \* P<0.05 for pretest to posttest comparisons within the balance training group. † P<0.05 for between group comparisons at posttest.

**Principal Investigator:**



**Patrick O. McKeon, PhD, ATC, CSCS**

Patrick McKeon is an Assistant Professor in the Division of Athletic Training at the University of Kentucky. In May of 2007, he earned his PhD in Sports Medicine from the University of Virginia in Charlottesville, VA. In 2001, Patrick earned his MS degree in Sports Health Care from the Arizona School of Health Sciences in Phoenix, AZ. Patrick earned is BS in Athletic Training from Springfield College in 1997. Currently, Patrick's research interests include spatiotemporal postural control alterations associated with lower extremity injury risk in high school athletes.

**Publication & Presentation List**

McKeon PO, Paolini G, Ingersoll CD, Kerrigan DC, Bennett BC, Hertel, J. Balance training significantly alters ankle coupling variability in those with chronic ankle instability. 2008. Gait and Clinical Movement Analysis Society Annual Meeting, Richmond, VA.

McKeon PO, Paolini G, Ingersoll CD, Kerrigan DC, Bennett BC, Hertel J. Balance training significantly alters ankle kinematics during gait in those with chronic ankle instability. 2008. American College of Sports Medicine Annual Meeting, Indianapolis, IN.

McKeon PO, Ingersoll CD, Kerrigan DC, Saliba EN, Bennett BC, Hertel J. Balance Training Significantly Improves Function and Postural Control in Those with Chronic Ankle Instability. National Athletic Trainers Association Annual Meeting.

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