NATA RESEARCH & EDUCATION FOUNDATION

Grant Information Summary:

Contributing Factors to Chronic Ankle Instability

Practical Significance Statement

Measures of mechanical and functional insufficiencies were predictive of chronic ankle instability status. Clinicians must be cognizant of the mechanical and functional insufficiencies associated with chronic ankle instability when designing intervention programs for patients who suffer from this condition.

Study Background

The development of repetitive ankle sprains and persistent symptoms after initial ankle sprain has been termed chronic ankle instability (CAI). Two contributing factors to CAI are functional ankle instability and mechanical ankle instability. Although the two may occur in isolation, it may be a combination of the two that causes CAI. Relatively few studies have examined these two factors concomitantly in fully understanding their contributions to chronic ankle instability. Presently, no clear indication exists as to what factors best classify individuals with and without CAI.

Objective

The purposes of this study were to 1) compare subjects who suffer from unilateral CAI with healthy matched controls on ankle laxity and hypomobility, static and dynamic balance, ankle and hip strength, selected lower extremity malalignments, and iliotibial band flexibility; 2) examine group comparisons of side-to-side symmetry indices for the above-mentioned variables, and 3) establish the relationship among these selected variables in chronically unstable ankles.

Design And Setting

This was a case control study. Data were collected at a medical center and the athletic training research laboratory. There were 31 dependent variables. The order of testing was randomized.

Subjects

Thirty subjects with unilateral CAI (15 males and 15 females, age=20.3 ± 1.3yr., mass= 72.9 ± 15.8kg, ht= 172.5 ± 10.7cm) and thirty subjects with no previous history of ankle injury (15 males and 15 females, age=21.3 ± 3.8yr., mass=71.9 ± 11.9kg, ht=172.6 ± 10.7cm), and thirty healthy controls were tested.

Measurements

Measures of ankle joint laxity and hypomobility (figure), static and dynamic balance, ankle and hip strength, selected lower extremity malalignments, and iliotibial band flexibility were taken on both limbs of all subjects.

Results

For the group comparisons of the involved ankles, separate 2 x 2 mixed model ANOVAs were calculated for each dependent variable with the between factor being group (CAI, control) and the within factor being side (involved, uninvolved). Thirteen variables (anterior displacement, inversion rotation, plantar flexion peak torque, hip abduction strength, hip extension strength, posterior medial reach, anterior reach, eversion rotation, balance trials missed, plantar flexion to dorsiflexion peak torque, eversion to inversion peak torque, inversion peak torque and fibular position) were identified as being significantly different between groups and were entered into a discriminant analysis. These variables explained 55.4% of CAI group membership. The measures that significantly classified CAI group membership were: increased inversion rotation, increased anterior displacement, more missed balance trials, and lower plantar flexion to dorsiflexion peak torque ratio. These four variables correctly predicted group membership in 86.7% of subjects.

To assess differences within the ankles of the CAI and control groups, symmetry indices comparing the involved and uninvolved sides of each subject were calculated for each dependent variable and compared between groups using independent t-tests. Eight variables (anterior displacement, inversion rotation, posterior medial reach, anterior reach, eversion average torque, plantar flexion peak torque, plantar flexion to dorsiflexion peak torque, and hip abduction strength) were identified as being significantly different between groups and were entered into a discriminant analysis. These factors explained 46.5% of CAI group membership. The measures that significantly predicted CAI group membership were: decreased anterior reach, diminished plantar flexion peak torque, decreased posterior medial reach, and more inversion rotation. These four variables correctly predicted group membership in 80.0% of CAI subjects and 73.3% of healthy subjects.

For the CAI involved ankles, Pearson Product Moment correlations were made between all dependent variables. Several significant bivariate correlations were identified. Both hip extension ($r = .48$, $r = .49$) and abduction ($r = .51$, $r = .49$) strength correlated moderately with posterior medial and posterior lateral reach. Hip extension strength also correlated moderately with plantar flexion average power ($r = .40$) and dorsiflexion peak torque ($r = .43$), whereas hip abduction strength correlated moderately with COP velocity eyes closed ($r = .49$). Other moderate relationships included fibular position with eversion average power ($r = .39$), posterior displacement with posterior lateral reach ($r = .46$) and knee hyperextension ($r = .42$), inversion rotation with tibial varum ($r = .48$), balance trials missed with plantar flexion ($r = -.44$) and dorsiflexion average power ($r = -.48$), eversion to inversion peak torque ratio with COP velocity eyes closed ($r = .42$), and Obers test with COP velocity eyes open ($r = .48$) and COP area eyes closed ($r = .56$).

Conclusions

The results of this study elucidate the specific measures that best discriminate between subjects with and without CAI. Selective measures (ankle laxity, plantar flexion strength, and dynamic balance) of both mechanical and functional insufficiencies significantly contribute to the etiology of CAI.

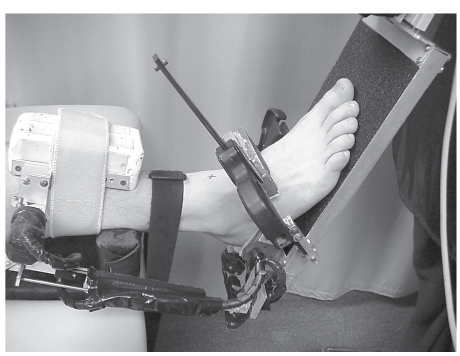

Figure. Setup for instrumented assessment of ankle joint laxity

Principal Investigator:

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Tricia J. Hubbard recently completed her Doctorate in Kinesiology from the Pennsylvania State University in August of 2005. She is currently an Assistant Professor and Director of the Athletic Training Education Program at The University of North Carolina at Charlotte.

Publication & Presentation List

Contributing Factors to Chronic Ankle Instability. *SEACSM Annual Meeting*, Free Communications Presentation, Charlotte, NC, 2006.

Contributing Factors to Chronic Ankle Instability. *ACSM Annual Meeting*, Free Communications Presentation. Denver, CO. May 2006.

Factors Associated with Chronic Ankle Instability. *NATA Annual Meeting*, Free Communications Presentation. Atlanta, GA. June 2006.

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