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Clinical and laboratory measures associated with health-related quality of life in individuals with chronic ankle instability

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ABSTRACT

Objective: To identify clinician and laboratory-oriented measures of function capable of explaining health-related quality of life in individuals with chronic ankle instability.
Design: Cross-sectional.
Setting: Laboratory.
Participants: Forty physically active individuals with chronic ankle instability attended a single testing session.
Main outcome measures: Participants completed health-related quality of life, postural control, strength, sensory, and mechanical assessments. Health-related quality of life assessments included the Short Form-12 Physical and Mental Summary Components, Disablement in the Physically Active Scale, Fear-Avoidance Beliefs Questionnaire, and the Foot and Ankle Ability Measure.
Results: A combination of mechanical and functional impairments accounted for 18–35% of the variance associated with health-related quality of life related to physical function and fear. Although physical impairments accounted for 7% of the variance associated with mental health-related quality of life, the overall model was associated with a weak effect size.
Conclusion: Measures of postural control, dorsiflexion range of motion, plantar cutaneous sensation, and ankle arthrometry contributed to a significant proportion of the variance associated with health-related quality of life in those with chronic ankle instability. Other variables should be examined to address mental components of health-related quality of life.

1. Introduction

Ankle sprains are common injuries experienced by physically active individuals. Approximately 23,000 sprains occur each day in the United States, (Hertel, 2002) resulting in over $4 billion in annual aggregate health care costs. To further confound the problem, up to 70% of people who sustain a single ankle sprain experience additional ankle sprains, recurrent bouts of joint instability, and decreased health-related quality of life (HRQOL) which are the hallmark characteristics of a health condition known as chronic ankle instability (CAI). (Anandacoomarasamy & Barnsley, 2005; Hertel, 2002). Therefore, the prevelance of CAI coupled with long-term consequences including degenerative joint disease, physical inactivity, and decreased HRQOL advocates for further understanding of this condition.

In comparison to individuals with no history of ankle sprains, those with CAI have reported functional deficits in activities of daily living and sports-related activities, as well as, elevated levels of injury-related fear. (Arnold, Wright, & Ross, 2011; Hale & Hertel, 2005; Houston, Van Lunen, & Hoch, 2015). Such deficits, collectively referred to as HRQOL, have been captured on a variety of generic, region-specific, and dimension-specific patient-reported outcomes (PROs). PROs are self-reported questionnaires that ask questions regarding the patient's perception of his or her condition, injury, or overall health status. (Snyder & Valovich McLeod, 2007). In people with CAI, PRO instruments such as the Short-Form-36 (SF-36), (Ware & Sherbourne, 1992), Foot and Ankle Ability Measure (FAAM), (Martin, Irrgang, Burdett, Ped, Conti, & Van

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Swearingen, 2005) and Tampa Scale of Kinesiophobia-11 (TSK-11) (Woby, Roach, Urmston, & Watson, 2005) have been used to evaluate HRQOL. Furthermore, kinesiophobia has been reported to be the strongest single contributor to self-reported function in patients with foot and ankle pathologies. (Lentz, Sutton, Greenberg, & Bishop, 2010). While this dimension-specific aspect of function has not been extensively investigated in those with CAI, it may be critical to understanding the health condition. Therefore, generic, region-specific, and dimension-specific aspects of self-reported function require further investigation in those with CAI.

Despite the knowledge of functional loss in those with CAI, it remains unclear how the multitude of mechanical and functional impairments (Hertel, 2002) demonstrated by these individuals contribute to the described decrements in HRQOL. The most defined areas of impairment include postural control deficits, (Arnold, De La Motte, Linens, & Ross, 2009), strength deficits, (Arnold, Linens, de la Motte, Ross, 2009), sensory alterations, (McKeon & McKeon, 2012) and mechanical alterations. (Hubbard, Kramer, Denegar, & Hertel, 2007). While each of these areas of impairment create unique CAI-related deficits, it is likely that an interaction between impairments is responsible for this clinical phenomenon. Despite the vast amount of research examining structural and functional impairment, it remains unclear which impairment or group of impairments may contribute to the self-reported loss of function and injury-related fear in individuals with CAI. Identifying the strongest contributors to functional loss and injury-related fear may point researchers and clinicians in a direction towards a combination of interventions which may be most beneficial from the perspective of body structure and function (impairment), the person (activity), and the person in their environment (participation). Consequently, the interventions may have a positive impact on the patient's quality of life.

Patient perception of his or her health status is becoming increasingly recognized in health care, some would even argue that it is the most important criterion for judging the effectiveness of treatment. (Parker, Nester, Long, & Barrie, 2003). Examining the potential relationships between measures of self-reported function and impairments in postural control, strength, sensation, and ankle mechanics may elucidate the most meaningful paths towards developing evidence-based rehabilitation strategies for those with CAI. Therefore, the purpose of this study was to identify clinician and laboratory-oriented measures of function capable of explaining PRO scores in individuals with CAI. It is hypothesized that a combination of measures will explain a significant amount of the variance associated with generic, region-specific, and dimension-specific outcomes in those with CAI.

2. Methods

2.1. Design

A cross-sectional design was employed for this study. Four PROs and 17 clinician and laboratory-oriented measures of function including measures of static and dynamic postural control, isometric strength, plantar cutaneous sensation, joint position sense, dorsiflexion range of motion, and ankle arthrometry were assessed during a single-testing session.

2.2. Participants

Forty physically active individuals with self-reported CAI (13 males, 27 females), were recruited from a large public university community over a one year period to participate in this study. Participants were included if they reported a score of four or greater on the National Aeronautics and Space Administration (NASA) Physical Activity Scale, reported a history of at least one or more ankle sprains, and at least one episode of “giving way” in the last three months. Additionally, all participants had to answer “yes” to five or more questions on the Ankle Instability Instrument (AII) and score less than 24 on the Cumberland Ankle Instability Tool (CAIT). (Donahue, Simon, & Docherty, 2011). Participants were excluded if they had experienced any lower extremity injuries in the last six months, had a history of lower extremity surgery, or suffered from any neurological disorders that could influence balance. In the event of bilateral CAI, the ankle with the lower CAIT score was considered the involved limb for the purposes of this study. All participants completed an informed consent document approved by the University's Institutional Review Board.

2.3. Instrumentation

An Accusway Plus force plate (AMTI; Watertown, MA) was used to assess static postural control. Center of pressure was sampled at 50 Hz and separated into anterior-posterior (AP) and medial-lateral (ML) directions and analyzed as time-to-boundary (TTB) variables. A handheld dynamometer (MicroFET2™, Hoggan Health Industries, Inc., West Jordan, UT) was used to assess isometric strength at the ankle. A 20-piece Semmes-Weinstein Monofilament kit (Texas Medical Design, Inc., Stafford, TX) was used to evaluate plantar cutaneous sensation. Lastly, a 6-degree of freedom Hollis Ankle Arthrometer (Blue Bay Research Inc., Navarre, FL) was used to measure mechanical laxity at the ankle.

2.4. Procedures

All participants reported to the laboratory for a single testing session. After agreeing to participate, participants completed two inclusionary instruments (i.e., AII and CAIT) and four PROs (i.e., Short Form-12 (SF-12), Disablement in the Physically Active Scale (DPA), Fear-Avoidance Beliefs Questionnaire (FABQ), and FAAM). Upon completion of the inclusionary and outcome instruments, participants completed seven tests to examine mechanical and functional impairments in the involved limb. Testing order for the clinician and laboratory-oriented measures were counterbalanced using a Latin square. Individual testing procedures are described below.

2.4.1. Patient-reported outcomes

Four PRO instruments were used to measure self-reported function: the SF-12 (Ware, Kosinski, & Keller, 1996), the DPA, (Vela & Denegar, 2010), the FABQ (Waddell, Newton, Henderson, Somerville, & Main, 1993) and the FAAM. (Martin et al., 2005). The SF-12 (Ware et al., 1996) is a generic health survey with physical (SF-12 PCS) and mental (SF-12 MCS) component summary scales. The DPA (Vela & Denegar, 2010) is a generic measure of health used in the evaluation of physically active individuals with musculoskeletal injuries. DPA scores range from 0 to 64 with higher scores representing functional limitations and decreased emotional well-being. The FABQ (Waddell et al., 1993) is a dimension-specific measure of health used to examine fear-avoidance beliefs. FABQ scores range from 0 to 66 with higher scores representing increased fear-avoidance beliefs. The FAAM (Martin et al., 2005) is a region-specific measure of health used to assess the physical performance of individuals with a broad range of ankle and foot musculoskeletal disorders. Comprised of two subscales the FAAM assesses physical function related to activities of daily living (FAAM-ADL) and sport (FAAM-Sport). FAAM-ADL and FAAM-Sport scores range from 0 to 100% with 100% representing normal function. All four PRO instruments have demonstrated sufficient reliability. (Carcia, Martin, & Drouin, 2008; Vela & Denegar, 2010; Waddell et al., 1993; Ware et al., 1996). After meeting the inclusion criteria,