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Health-Related Quality of Life in Individuals With Chronic Ankle Instability

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Context: Individuals with chronic ankle instability (CAI) have reported decreased global and regional function. Despite the identification of functional deficits in those with CAI, more research is required to determine the extent to which CAI influences the multidimensional profile of health-related quality of life.

Objective: To determine whether global, regional, and psychological health-related outcomes differ between individuals with and without CAI.

Design: Case-control study.

Setting: Laboratory.

Patients or Other Participants: Twenty-five participants with CAI (age = 21.9 ± 2.5 years, height = 170.8 ± 8.6 cm, mass = 69.8.0 ± 11.7 kg) were sex- and limb-matched to 25 healthy participants (age = 22.0 ± 2.1 years, height = 167.4 ± 9.1 cm, mass = 64.8 ± 11.2 kg).

Main Outcome Measure(s): Both groups completed the Disablement in the Physically Active Scale, the Foot and Ankle Ability Measure (FAAM), the FAAM-Sport, the Tampa Scale of Kinesiophobia-11, and the Fear-Avoidance Beliefs Questionnaire. Dependent variables were scores on these instruments, and the independent variable was group.

Results: Compared with healthy individuals, those with CAI reported decreased function on the Disablement in the Physically Active Scale, FAAM, and FAAM-Sport ($P < .001$) and increased fear of reinjury on the Tampa Scale of Kinesiophobia-11 and Fear-Avoidance Beliefs Questionnaire ($P < .001$). In the CAI group, the FAAM and FAAM-Sport demonstrated a significant relationship ($r = 0.774$, $P < .01$).

Conclusions: Individuals with CAI reported decreased function and increased fear of reinjury compared with healthy control participants. Also, within the CAI group, there was a strong relationship between FAAM and FAAM-Sport scores but not between any other instruments. These findings suggest that health-related quality of life should be examined during the rehabilitation process of individuals with CAI.

Key Words: ankle sprains, impairment, fear of reinjury, psychology

Key Points

- Individuals with chronic ankle instability reported global, regional, and psychological health-related quality-of-life deficits compared with healthy control participants.
- Functional deficits and psychological barriers reported by the patient should be taken into consideration when clinicians treat individuals with chronic ankle instability.

Individuals around the globe engage in physical activity for personal interest or general health and fitness, subjecting the ankle to various conditions in which injury could occur. Roughly one-half of all ankle sprains in the United States occur during athletic activity,[1,2] and an estimated 3 million patients with ankle sprains and strains seek treatment in hospital emergency departments or in a physician's office each year.[3] Within the past decade, ankle sprains have represented approximately 80% of ankle injuries in athletes[4,5] and military cadets,[1] resulting in immense health care costs. Further contributing to the problem, up to 74% of patients who sustain a single ankle sprain go on to develop residual symptoms that may persist years after the initial injury,[6] with many developing chronic ankle instability (CAI).[7–9] Chronic ankle instability, or recurring ankle sprains and repetitive giving way of the ankle during functional activities, has been linked to both mechanical and functional impairments.[10] Those impairments are thought to contribute to long-term limitations and restrictions in recreational and occupational activities that consequently affect health-related quality of life (HRQOL).[9,11]

Encompassing social, physical, and psychological health components, HRQOL is a multidimensional approach to health care[12] that has become an integral part of health surveillance. Because of the multidimensional nature of HRQOL, a variety of self-reported instruments have been designed to measure global, regional, and psychological health components. Global instruments (also known as generic instruments) are nonspecific to body region or condition and designed to assess the patient's overall health, whereas regional instruments can be specific to a joint or region of the body, such as the lower extremity.[13] Psychological instruments capture various aspects of the patient's mental or social function, such as fear of reinjury. *Fear of reinjury* is the concept of fear after injury and includes but is not limited to kinesiophobia, fear-avoidance beliefs, or reinjury anxiety. Self-reported instruments enhance the clinician's ability to incorporate patient values and perspectives and are a vital component of the evidence-based practice model.[14]

Chronic ankle instability has been associated with decreased HRQOL based on global and regional outcomes.[15,16] Individuals with CAI have reported decreased global function on the Short Form-36 (SF-36).[16] Furthermore, Arnold et al[16] found a moderately positive correlation between SF-36 Physical Function domain scores and the Foot and Ankle Ability Measure (FAAM), a regional measure of function that includes both Activities of Daily Living (FAAM-ADL) and Sport subscales (FAAM-Sport). This relationship suggests that CAI may reduce overall HRQOL. Individuals with CAI have also reported decreased function on other regional instruments, such as the Ankle Joint Functional Assessment Tool, Foot and Ankle Disability Index (FADI), and FADI-Sport.[15,17–19] On a variety of self-reported instruments, both global and regional deficits have been detected in physically active individuals with CAI.

Despite identifying global and regional HRQOL deficits in those with CAI, more research is required to determine the extent to which CAI influences the multidimensional profile of HRQOL. Therefore, examining global function using a scale designed for physically active individuals or psychological measures, such as kinesiophobia and fear-avoidance beliefs, could reveal more about the condition. To our knowledge, scores on the Disablement in the Physically Active Scale (DPA), Tampa Scale of Kinesiophobia-11 (TSK-11), and Fear-Avoidance Beliefs Questionnaire (FABQ) have yet to be examined in the CAI population. Using instruments that encompass the multidimensional profile of HRQOL will enhance the clinician's ability to incorporate patient values and perspectives into rehabilitation and outcomes assessment.

Although fear of reinjury has been associated with a variety of orthopaedic conditions,[20–23] little evidence supports the presence of kinesiophobia or fear-avoidance beliefs in patients with CAI. Wikstrom[24] reported that TSK-17 scores did not differ between individuals with CAI and "copers"; however, both groups reported elevated levels of kinesiophobia. Left unaddressed, global and regional functional deficits, as well as fears of reinjury, may contribute to long-term consequences associated with CAI, such as degenerative joint disease[25] and decreased physical activity.[9] Therefore, the primary purpose of our investigation was to determine whether global, regional, and psychological health outcomes differed between individuals with and without CAI. The secondary purpose was to examine relationships among instruments and between injury-history characteristics and instrument scores in the CAI group. We hypothesized that individuals with CAI would exhibit decreased global and regional function and increased fear of reinjury compared with healthy individuals. Additionally, we proposed that relationships would exist among health-related outcomes instruments and between injury-history characteristics and instrument scores.

METHODS

We used a case-control design to examine differences between individuals with and without CAI. The independent variable was group (CAI or healthy) and the dependent variables were global (DPA), regional (FAAM-ADL and FAAM-Sport), and psychological (TSK-11 and FABQ) health-related outcomes.

Table 1. Participant Characteristics by Group

Characteristic	Group: Chronic Ankle Instability	Group: Healthy
Age, mean ± SD, y	21.9 ± 2.5	22.0 ± 2.1
Height, mean ± SD, cm	170.8 ± 8.6	167.4 ± 9.1
Weight, mean ± SD, kg	69.8 ± 11.7	64.8 ± 11.2
Episodes of giving way, median (IQ range)	3.0 (2.0–5.5)	0.0 (0.0–0.0)
Previous ankle sprains, median (IQ range)	3.0 (1.5–5.0)	0.0 (0.0–0.0)
NASA Physical Activity Scale, median (IQ range)	6.5 (5.0–7.3)	6.0 (5.0–7.0)

Abbreviations: IQ, interquartile range; NASA, National Aeronautics and Space Administration.

Participants

Twenty-five physically active participants with CAI (7 men [28%], 18 women [72%], age = 21.9 ± 2.5 years, height = 170.2 ± 9.1 cm, mass = 70.0 ± 11.4 kg) were matched by sex and limb to 25 physically active participants with no history of ankle sprain (7 men [28%], 18 women [72%], age = 22.0 ± 2.1 years, height = 167.4 ± 9.1 cm, mass = 64.8 ± 11.2 kg). All participants reported a score of 4 or greater on the National Aeronautics and Space Administration (NASA) Physical Activity Status Scale. Median scores on the NASA Physical Activity Status Scale for the CAI and healthy groups were 6.5 and 6, respectively, indicating that these individuals were involved in heavy aerobic exercise for 1 to 3 h/wk. Participants were included in the CAI group if they reported a history of at least 1 lateral ankle sprain and 2 episodes of "giving way" in the past 3 months and answered *yes* to 4 or more questions on the Ankle Instability Instrument (AII). Participants were excluded if they reported having an ankle sprain in the previous 6 weeks, a lower extremity injury in the previous 6 months, or any history of lower extremity surgery. In the event of bilateral CAI, the ankle with the most reported episodes of giving way on the AII was considered the involved limb for the purposes of this study. Participant characteristics are reported in Table 1. All participants completed an informed consent document approved by the University's institutional review board, which also approved the study.

Procedures

All participants reported to the laboratory for a single testing session. After reading and signing the informed consent document, they completed the AII, NASA Physical Activity Status Scale, FAAM-ADL, FAAM-Sport, FABQ, TSK-11, and DPA instruments in this order. The AII and NASA Physical Activity Status Scale were used as inclusionary instruments. The TSK-11 and FABQ were used to quantify fear of reinjury, and the FAAM and DPA addressed regional and global function, respectively. We administered the survey instruments in paper format. Participants were asked to complete all 7 instruments as instructed by the directions at the top of each page. The

Table 2. Health-Related Outcomes by Group, Median (Interquartile Range)

Instrument		Group, Mean (Range)		Mann-Whitney *U P* Value
		Chronic Ankle Instability	Healthy	
Global	Disablement in the Physically Active Scale	14 (11–19)	0 (0–0)	<.001
Regional	Foot and Ankle Ability Measure-Activities of Daily Living	91 (85–93)	100 (100–100)	<.001
	Foot and Ankle Ability Measure-Sport	78 (69–86)	100 (100–100)	<.001
Psychological	Tampa Scale of Kinesiophobia-11	18 (17–21)	13 (11–16)	<.001
	Fear-Avoidance Beliefs Questionnaire	13 (9–26)	0 (0–3)	<.001

investigator did not provide further explanation unless the participant asked for clarification, in which case the investigator attempted to provide an unbiased response. After completion, the primary investigator (M.N.H.) examined the instrument for missing items and asked the participant to respond to these items. The primary investigator scored all of the survey instruments for analysis based on the established guidelines.

Instrumentation

Disablement in the Physically Active Scale. The DPA[26] is a 16-item global-outcome instrument designed by athletic trainers for physically active individuals. The multidimensional scale is rooted in both current disablement and HRQOL paradigms. Responses are based on a 5-point Likert scale ranging from *no problem* to *severe*.[26] Each item is weighted equally, and DPA scores range from 0 to 64, with higher scores indicating increased disablement. High test-retest reliability (intraclass correlation coefficient [ICC] = 0.943) and internal consistency ($\alpha = 0.890$–0.908) values have been reported for the DPA.[26]

Foot and Ankle Ability Measure. The FAAM is a region-specific instrument designed to quantify activity limitations and participation restrictions associated with foot and ankle conditions.[27] Comprising 2 subscales, the FAAM-ADL contains 21 items, whereas the FAAM-Sport scale contains 8 items. All items are scored on a 5-point Likert scale (0–4) from *no difficulty at all* to *unable to do*. Scores range from 0 to 84 (FAAM-ADL) and 0 to 32 (FAAM-Sport) and are transformed into percentages, with 100% representing no functional loss. Test-retest reliability for the FAAM-ADL and FAAM-Sport was 0.89 and 0.87, respectively.[27] Internal consistency for the FAAM-ADL and FAAM-Sport was 0.98 and 0.96, respectively.[27]

Tampa Scale of Kinesiophobia-11. The TSK-11 is an 11-item questionnaire designed to assess fear of movement and reinjury while offering the advantage of brevity. All items are based on a 4-point Likert scale in which patient options range from *strongly disagree* to *strongly agree*. The TSK-11 scores range from 11 to 44, with higher scores indicating a higher degree of kinesiophobia. Despite the shortened format, the TSK-11 has demonstrated similar factor structure, internal consistency ($\alpha = 0.79$), test-retest reliability (ICC = 0.81), and validity to the original TSK-17.[29] The shortened version has been used extensively in orthopaedic populations, including patients with low back pain,[29] neck and shoulder pain,[30] and lower extremity disability.[31]

Fear-Avoidance Beliefs Questionnaire. The FABQ[28] is a 16-item questionnaire designed to assess fear-avoidance beliefs. Each item is scored on a 7-point Likert scale from *completely disagree* to *completely agree*. Fear-Avoidance Beliefs Questionnaire scores range from 0 to 66, with higher scores representing increased fear-avoidance beliefs. High test-retest reliability (ICC = 0.77–0.90) and internal consistency ($\alpha = 0.79$–0.91) have been reported for the instrument.[32]

Statistical Analysis

We used separate Mann-Whitney *U* tests to determine whether differences existed in global, regional, and psychological health-related outcomes between individuals with and without CAI. The significance level was set at $P \leq .01$ to adjust for multiple comparisons. As a secondary analysis, Spearman ρ correlations were calculated to examine relationships among instruments as well as between instruments and injury-history characteristics in the CAI group. Correlation coefficients of 0.01 to 0.39 were interpreted as *weak* relationships, 0.40 to 0.69 as *moderate*, and 0.70 to 1.0 as *strong*.[33] The α level for correlations was set at $P \leq .05$. All analyses were conducted using the SPSS software (version 21.0; formerly SPSS Inc, now IBM Corporation, Armonk, NY).

RESULTS

We identified differences between the CAI group and the healthy group for global, regional, and psychological health-related outcomes (Table 2). Compared with healthy individuals, those with CAI reported decreased function on the FAAM-ADL, FAAM-Sport, and DPA ($P < .001$). Individuals with CAI also reported increased fear of reinjury on both the FABQ and the TSK-11 ($P < .001$). Within the CAI group, a strong positive correlation was demonstrated between the FAAM-ADL and FAAM-Sport ($r = 0.774$; $P < .01$). No other significant correlations were identified ($P > .05$). Correlation coefficients are presented in Table 3.

DISCUSSION

Our primary purpose was to determine whether global, regional, and psychologic health-related outcomes differed between individuals with and without CAI. We also examined relationships among outcomes scores as well as among outcomes scores and injury-history characteristics within the CAI group to identify any association among instruments. Overall, individuals with CAI reported decreased global and regional function as well as increased fears of reinjury compared with healthy individuals. Additionally, within the CAI group, we identified a strong positive relationship between the FAAM-ADL and FAAM-Sport but no other significant relationships.

Table 3. Spearman Correlations Among Health-Related Outcomes and Inclusion Criteria in the Chronic Ankle Instability Group

Instrument	DPA	FAAM-ADL	FAAM-Sport	TSK-11	FABQ
DPA	1				
FAAM-ADL	−0.216	1			
FAAM-Sport	−0.296	0.774[a]	1		
TSK-11	0.371	−0.070	−0.219	1	
FABQ	−0.038	−0.103	0.003	0.210	1
Episodes of giving way	−0.043	−0.029	−0.088	−0.389	−0.010
Previous ankle sprains	0.269	−0.286	−0.363	0.018	0.089
NASA Physical Activity Scale	−0.172	0.014	−0.143	−0.267	0.090

Abbreviations: DPA, Disablement in the Physically Active; FAAM-ADL, Foot and Ankle Ability Measure-Activities of Daily Living; FAAM-Sport, Foot and Ankle Ability Measure-Sport; FABQ, Fear-Avoidance Beliefs Questionnaire; NASA, National Aeronautics and Space Administration; TSK-11, Tampa Scale of Kinesiophobia-11.

[a] $P < .05$.

Between-Groups Comparisons

We hypothesized that individuals with CAI would display global and regional deficits in addition to a heightened fear of reinjury, such as kinesiophobia and fear-avoidance beliefs. Our results confirmed that hypothesis because individuals with CAI reported lower scores on the FAAM and higher scores on the FABQ, TSK-11, and DPA (Table 2). Although other investigators[15,16,18] have reported decreased global and regional functional scores in individuals with CAI, to our knowledge, no one has examined global function using an instrument designed for physically active individuals or fear of reinjury in this population. Our results agree with findings in other populations, such as individuals with patellofemoral pain[20] and patients after anterior cruciate ligament reconstruction.[34] These findings highlight the need to evaluate function local to the ankle, as well as globally, to fully understand the scope of HRQOL changes in patients with CAI.

Our results suggest that CAI influences psychological health-related outcomes associated with fear of reinjury. Although others have measured global and regional function in this population, only 1 author has examined the fear of reinjury. Wikstrom[24] compared fear of reinjury using the original TSK-17 (score range = 17–68) in ankle-sprain copers (TSK-17 = 30.5 ± 5.7) and individuals with CAI (TSK-17 = 31.6 ± 4.4) and reported that kinesiophobia scores did not differ between groups (Cohen *d* effect size = 0.22). Rather than interpret these findings as insignificant or clinically irrelevant, it may be that both groups reported elevated levels of kinesiophobia. The elevated TSK-17 scores in both the coper and CAI groups suggest that kinesiophobia may still be present in ankle-sprain copers, even though they had resumed physical activity levels without limitation and additional injury. Using the TSK-11 (score range = 11–44), we identified a large magnitude of difference between groups (healthy control group = 13.4 ± 2.7, CAI group = 19.1 ± 4.3; Cohen *d* effect size = 1.59). The heightened fear of reinjury scores reported by individuals with a history of ankle sprain reiterates the importance of assessing the multidimensional profile of HRQOL. Overall, these findings indicate that fear of reinjury should be further examined in individuals with a history of ankle sprain.

Relationships Among Outcomes Instruments in the CAI Group

We hypothesized that relationships would exist between health-related outcomes instruments. We observed a strong positive correlation (r = 0.774) between the FAAM subscales. The correlation suggests they measure similar constructs, which is logical because they both assess activity limitations and participation restrictions specific to the foot and ankle. However, no significant relationships were noted among global, regional, or psychological outcomes. The weak correlation between global and regional instruments indicates that the DPA and FAAM measure different aspects of function and that both should continue to be used. Furthermore, the weak correlation between the FABQ and the TSK-11 suggests those outcomes capture different aspects of fear of reinjury and that both should continue to be used. Therefore, global, regional, and psychological health-related outcomes should be assessed in individuals with CAI using a variety of outcomes instruments.

Finally, the number of previous ankle sprains, episodes of giving way, or physical activity level did not significantly correlate with any instrument scores. Although we believe our sample represented individuals across the continuum of CAI, it does not appear that basic injury-history characteristics greatly influenced the instrument scores in this study. Examining how more-specific functional and mechanical impairments contribute to global, regional, and psychological HRQOL may provide insight into HRQOL deficits. For example, Hubbard-Turner[35] observed a strong relationship between ankle laxity and regional function using the FADI and FADI-Sport. As scores on the FADI (r = –0.65) and FADI-Sport (r = –0.88) decreased, anterior laxity increased. Moderate negative correlations were also demonstrated between FADI (r = –0.53) and FADI-Sport (r = –0.45) scores and inversion laxity. Possible relationships between mechanical and functional deficits and health-related outcomes should be explored in future investigations.

Clinical Implications

Limited evidence exists for global[16] and fear-of-reinjury outcomes in individuals with CAI, but based on the results of this investigation, those elements may be critical to understanding the consequences of clinical interventions. In our study, individuals with CAI reported functional and psychological deficits associated with their unstable ankle. Left unaddressed, such components may contribute to long-term consequences associated with the condition. Although the exact cause of the reported deficits is unknown, previous investigators[36–38] have shown that various rehabilitation techniques improve regional measures of function. Hence, regional measures of function appear to be modifiable. To our knowledge, no one has examined the influence of ankle-instability rehabilitation techniques on global function or on the fear of reinjury. To evaluate treatment efficacy and better monitor patient status, clinicians should use global, regional, and psychological outcomes.

To provide a clinical interpretation of our findings, we examined our data in the contexts of minimal detectable change (MDC) and minimal clinically important difference (MCID) scores when reported in the literature. The MDC indicates the amount of change required to exceed measurement variability,[39] whereas the MCID indicates the smallest difference that a patient perceives as a change in health status.[40] In individuals with CAI, MDC scores of 3.96%[36] and 7.9%[36] have been reported for the FAAM-ADL and FAAM-Sport, respectively. The median difference between groups in our study was 9% for the FAAM-ADL and 12% for the FAAM-Sport, indicating that these participants not only displayed significant differences compared with the healthy group but also had room for clinically meaningful improvement. For the DPA, physically active individuals with persistent injuries had an MDC score of 4.21 and an MCID score of 9 points.[26] Again, the median difference of 14 points between our groups exceeded both scores, showing that participants with CAI displayed significantly lower HRQOL than the healthy group but also the possibility for clinically meaningful improvement. The MDC and MCID scores for the TSK-11 and FABQ have not, to our knowledge, been reported for individuals with CAI or a population similar to the physically active individuals included in this study and should be a consideration for future research.

Limitations

The present study was not without limitations. First, because of the retrospective study design, we cannot make a causal link between CAI and decreased health-related outcomes. Second, the data were collected from a sample of physically active individuals between the ages of 18 and 30 years; thus, our results are not applicable to younger or older cohorts of individuals with CAI. Similarly, more-homogeneous groups of individuals with CAI, such as elite or collegiate athletes, may respond differently than general physically active individuals do. Third, some participants had a history of bilateral ankle sprains or instability that might have contributed to decreased global function or increased fear of reinjury. Of our sample of individuals with CAI, 6 (24%) reported bilateral CAI, 4 (16%) reported unilateral CAI, and 15 (60%) reported a range of bilateral ankle-sprain histories. An exploratory analysis between those with bilateral and unilateral instability demonstrated no differences in FABQ ($P = .07$), TSK-11 ($P = .61$), or DPA ($P = .48$) scores. Fourth, we did not administer the outcomes instruments in a counterbalanced order. The effect of administration sequence with these instruments is unknown at this time; however, the opportunity for bias may exist because of the order in which individuals complete these instruments. Future investigators may consider counterbalancing the administration of HRQOL instruments, examining these results in more specific subgroups with CAI and investigating the influence of bilateral instability.

CONCLUSIONS

Individuals with CAI displayed decreased global and regional function and increased fear of reinjury. Clinicians treating patients postankle sprains should evaluate the patient's perception of function using both global and regional instruments and assess the person's fear of reinjury. When treating individuals with CAI, clinicians should consider functional deficits and psychological barriers to improve the quality of patient care. Future researchers should evaluate the relationships among health-related outcomes and mechanical and functional insufficiencies associated with CAI, as well as the influence of rehabilitation techniques on the multidimensional profile of HRQOL.

REFERENCES

1. Waterman BR, Belmont PJ Jr, Cameron KL, Deberardino TM, Owens BD. Epidemiology of ankle sprain at the United States Military Academy. *Am J Sports Med*. 2010;38(4):797–803.
2. Waterman BR, Owens BD, Davey S, Zacchilli MA, Belmont PJ Jr. The epidemiology of ankle sprains in the United States. *J Bone Joint Surg Am*. 2010;92(13):2279–2284.
3. Schappert SM, Rechtsteiner EA. Ambulatory medical care utilization estimates for 2007. *Vital Health Stat*. 2011;13(169):1–38.
4. Nelson AJ, Collins CL, Yard EE, Fields SK. Comstock RD. Ankle injuries among United States high school sports athletes, 2005–2006. *J Athl Train*. 2007;42(3):381–387.
5. Fong DT, Hong Y, Chan LK, Yung PS, Chan KM. A systematic review on ankle injury and ankle sprain in sports. *Sports Med*. 2007; 37(1):73–94.
6. Anandacoomarasamy A, Barnsley L. Long term outcomes of inversion ankle injuries. *Br J Sports Med*. 2005;39(3):e14.
7. Braun BL. Effects of ankle sprain in a general clinic population 6 to 18 months after medical evaluation. *Arch Fam Med*. 1999;8(2):143–148.
8. Gerber JP, Williams GN, Scoville CR, Arciero RA, Taylor DC. Persistent disability associated with ankle sprains: a prospective examination of an athletic population. *Foot Ankle Int*. 1998;19(10): 653–660.
9. Verhagen RA, de Keizer G, van Dijk CN. Long-term follow-up of inversion trauma of the ankle. *Arch Orthop Trauma Surg*. 1995; 114(2):92–96.
10. Hertel J. Functional anatomy, pathomechanics, and pathophysiology of lateral ankle instability. *J Athl Train*. 2002;37(4):364–375.
11. Hiller CE, Nightingale EJ, Raymond J, et al. Prevalence and impact of chronic musculoskeletal ankle disorders in the community. *Arch Phys Med Rehabil*. 2012;93(10):1801–1807.
12. Parsons JT, Snyder AR. Health-related quality of life as a primary clinical outcome in sport rehabilitation. *J Sport Rehabil*. 2011;20(1): 17–36.
13. Valovich McLeod TC. Selecting patient-based outcome measures. *Athl Ther Today*. 2007;12(6):12–15.
14. Snyder AR, Parsons JT, Valovich McLeod TC, Curtis Bay R, Michener LA, Sauers EL. Using disablement models and clinical outcomes assessment to enable evidence-based athletic training practice, part I: disablement models. *J Athl Train*. 2008;43(4):428–436.
15. Carcia CR, Martin RL, Drouin JM. Validity of the foot and ankle ability measure in athletes with chronic ankle instability. *J Athl Train*. 2008;43(2):179–183.

16. Arnold BL, Wright CJ, Ross SE. Functional ankle instability and health-related quality of life. *J Athl Train*. 2011;46(6):634–641.
17. Rozzi SL, Lephart SM, Sterner R, Kuligowski L. Balance training for persons with functionally unstable ankles. *J Orthop Sports Phys Ther*.1999;29(8):478–486.
18. Hale SA, Hertel J. Reliability and sensitivity of the Foot and Ankle Disability Index in subjects with chronic ankle instability. *J Athl Train*. 2005;40(1):35–40.
19. Wikstrom EA, Tillman MD, Chmielewski TL, Cauraugh JH, Naugle KE, Borsa PA. Self-assessed disability and functional performance in individuals with and without ankle instability: a case control study. *J Orthop Sports Phys Ther*. 2009;39(6):458–467.
20. Piva SR, Fitzgerald GK, Wisniewski S, Delitto A. Predictors of pain and function outcome after rehabilitation in patients with patellofemoral pain syndrome. *J Rehabil Med*. 2009;41(8):604–612.
21. Lentz TA, Tillman SM, Indelicato PA, Moser MW, George SZ, Chmielewski TL. Factors associated with function after anterior cruciate ligament reconstruction. *Sports Health*. 2009;1(1):47–53.
22. Lentz TA, Barabas JA, Day T, Bishop MD, George SZ. The relationship of pain intensity, physical impairment, and pain-related fear to function in patients with shoulder pathology. *J Orthop Sports Phys Ther*. 2009;39(4):270–277.
23. Swinkels-Meewisse IE, Roelofs J, Verbeek AL, Oostendorp RA, Vlaeyen JW. Fear of movement/(re)injury, disability and participation in acute low back pain. *Pain*. 2003;105(1–2):371–379.
24. Wikstrom EA. Fear of re-injury does not differ between those with and without chronic ankle instability. *J Sports Sci Med*. 2011;10(4): 771–772.
25. Valderrabano V, Hintermann B, Horisberger M, Fung TS. Ligamentous posttraumatic ankle osteoarthritis. *Am J Sports Med*. 2006;34(4): 612–620.
26. Vela LI, Denegar CR. The Disablement in the Physically Active Scale, part II: the psychometric properties of an outcomes scale for musculoskeletal injuries. *J Athl Train*. 2010;45(6):630–641.
27. Martin RL, Irrgang JJ, Burdett RG, Conti SF, Van Swearingen JM. Evidence of validity for the Foot and Ankle Ability Measure (FAAM). *Foot Ankle Int*. 2005;26(11):968–983.
28. Waddell G, Newton M, Henderson I, Somerville D, Main CJ. A Fear-Avoidance Beliefs Questionnaire (FABQ) and the role of fear-avoidance beliefs in chronic low back pain and disability. *Pain*. 1993; 52(2):157–168.
29. Woby SR, Roach NK, Urmston M, Watson PJ. Psychometric properties of the TSK-11: a shortened version of the Tampa Scale for Kinesiophobia. *Pain*. 2005;117(1–2):137–144.
30. George SZ, Dover GC, Fillingim RB. Fear of pain influences outcomes after exercise-induced delayed onset muscle soreness at the shoulder. *Clin J Pain*. 2007;23(1):76–84.
31. Kvist J, Ek A, Sporrstedt K, Good L. Fear of re-injury: a hindrance for returning to sports after anterior cruciate ligament reconstruction. *Knee Surg Sports Traumatol Arthrosc*. 2005;13(5):393–397.
32. Jacob T, Baras M, Zeev A, Epstein L. Low back pain: reliability of a set of pain measurement tools. *Arch Phys Med Rehabil*. 2001;82(6): 735–742.
33. Lomax RG. *Statistical Concepts: A Second Course for Education and the Behavioral Sciences*. Hillsdale, NJ: Lawrence Erlbaum Associates; 1998.
34. Chmielewski TL, Jones D, Day T, Tillman SM, Lentz TA, George SZ. The association of pain and fear of movement/reinjury with function during anterior cruciate ligament reconstruction rehabilitation. *J Orthop Sports Phys Ther*. 2008;38(12):746–753.
35. Hubbard-Turner T. Relationship between mechanical ankle joint laxity and subjective function. *Foot Ankle Int*. 2012;33(10):852–856.
36. Hoch MC, Andreatta RD, Mullineaux DR, et al. Two-week joint mobilization intervention improves self-reported function, range of motion, and dynamic balance in those with chronic ankle instability. *J Orthop Res*. 2012;30(11):1798–1804.
37. McKeon PO, Ingersoll CD, Kerrigan DC, Saliba E, Bennett BC, Hertel J. Balance training improves function and postural control in those with chronic ankle instability. *Med Sci Sports Exerc*. 2008; 40(10):1810–1819.
38. Hale SA, Hertel J, Olmsted-Kramer LC. The effect of a 4-week comprehensive rehabilitation program on postural control and lower extremity function in individuals with chronic ankle instability. *J Orthop Sports Phys Ther*. 2007;37(6):303–311.
39. Michener LA, Leggin BG. A review of self-report scales for the assessment of functional limitation and disability of the shoulder. *J Hand Ther*. 2001;14(2):68–76.
40. Schmitt JS, Di Fabio RP. Reliable change and minimum important difference (MID) proportions facilitated group responsiveness comparisons using individual threshold criteria. *J Clin Epidemiol*. 2004;57(10):1008–1018.

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