ELSEVIER

CrossMark

The Spine Journal 14 (2014) 1936–1943

THE SPINE JOURNAL

Clinical Study

Longitudinal construct validity and responsiveness of measures of walking capacity in individuals with lumbar spinal stenosis

Christy C. Tomkins-Lane, PhD[a,*], Michele C. Battié, PhD[b], Luciana G. Macedo, PhD[b]

[a]*Mount Royal University, U243E, 4825 Mount Royal Gate SW, Calgary, Alberta, Canada T3E 6K6*

[b]*Department of Physical Therapy, Faculty of Rehabilitation Medicine, University of Alberta, 3-48 Corbett Hall, Edmonton, Alberta, Canada T6G 2G4*

Received 16 August 2012; revised 6 September 2013; accepted 7 November 2013

Abstract

BACKGROUND CONTEXT: Walking capacity is a primary outcome indicator for individuals with lumbar spinal stenosis (LSS). Therefore, there is a demand for psychometrically sound measures of walking that are responsive to change.

PURPOSE: The primary objective of this study was to examine longitudinal construct validity of the Physical Function Scale of the Swiss Spinal Stenosis Questionnaire (PF Scale), the Oswestry Disability Index (ODI), and the walking capacity items from these scales specifically for the assessment of walking capacity in LSS using the objective Self-Paced Walking Test (SPWT) as the external standard. A secondary objective was to examine responsiveness of measures of walking using a self-reported walking capacity change scale as the external criterion standard.

STUDY DESIGN: Patients were prospectively enrolled.

PATIENT SAMPLE: Twenty-six patients were included in this study (17 women and 9 men), with an average age of 68.5 years (SD, 9.2). All participants had LSS diagnosed by a spine specialist surgeon based on both clinical examination and imaging, as well as self-reported walking limitations (neurogenic claudication).

OUTCOME MEASURES: The self-reported outcome measures included in this study were PF Scale, ODI, and self-reported walking capacity change score.

FUNCTIONAL MEASURES: The functional measure used in the study was SPWT.

METHODS: Longitudinal construct validity was assessed using the correlational method. Internal responsiveness was examined using Guyatt responsiveness index and external responsiveness using receiver operating characteristic analysis. Change in the SPWT and the self-reported walking capacity change score were used as external criteria for the analysis.

RESULTS: The highest correlations with change in the SPWT were 0.78 for the ODI walking item and 0.78 for the walking capacity change score. Changes in the PF Scale and ODI score were correlated with change in the criterion SPWT at r=0.56 and r=0.70, respectively. There were no differences observed between the PF Scale and ODI for any of the responsiveness indices.

CONCLUSIONS: The PF Scale, ODI, and walking capacity change score are able to detect changes in walking capacity in people with LSS. The individual walking capacity item from the ODI appears to be the most valid and responsive to changes in measured walking and may be a reasonable alternative for measuring walking when an objective test such as the SPWT is not feasible.

Keywords: Validity; Responsiveness; Spinal stenosis; Walking; Outcomes; Neurogenic claudication

FDA device/drug status: Not applicable.

Author disclosures: ***CCT-L:*** Nothing to disclose. ***MCB:*** Grants: Alberta Innovates Health Solutions (C). ***LGM:*** Nothing to disclose.

The disclosure key can be found on the Table of Contents and at www.TheSpineJournalOnline.com.

The study was supported by the Health Research Fund administered by Alberta Innovates Health Solutions, as well as the EFF Support for the Advancement of Scholarship, University of Alberta. CCT-L received support for her doctoral research from the Alberta Heritage Foundation for Medical Research and the Alberta Provincial CIHR Training Program in Bone and Joint Health. MCB receives support from the Canada Research Chairs Program. LGM receives postdoctoral support from Canadian Institutes for Health Research and Alberta Innovates Health Solutions. There are no conflicts of interest.

* Corresponding author. Mount Royal University, U243E, 4825 Mount Royal Gate SW, Calgary, Alberta, Canada T3E 6K6. Tel.: (403) 440-8671; fax: (403) 440-6744.

E-mail address: clane@mtroyal.ca (C.C. Tomkins-Lane)

1529-9430/$ - see front matter
http://dx.doi.org/10.1016/j.spinee.2013.11.030

Introduction

People with lumbar spinal stenosis (LSS) often have limited walking capacities because of pain or neurologic symptoms associated with neurogenic claudication. Walking capacity is measured to assess functional status, treatment outcomes, and the natural progression of the condition. It has been suggested that improved walking capacity is the primary goal of most treatments for LSS [1]. Therefore, there is a demand for psychometrically sound measures of walking that are valid, reproducible, and responsive to change [2,3].

The Self-Paced Walking Test (SPWT) has been established as a criterion measure of walking capacity in people with LSS [4]. However, although observational tests are more accurate for measurement of walking, treatment outcomes in patients with LSS are often determined using self-reported questionnaires [5]. Self-reported instruments are generally more practical and easy to use. Of the self-reported instruments used to measure walking capacity in this population, only the Physical Function Scale of the Swiss Spinal Stenosis Questionnaire (PF Scale) [6] and the Oswestry Disability Index (ODI) [7,8] have been the focus of psychometric research. Both scales have been shown to be valid and reproducible for use in measurement of walking in patients with LSS [6,9–13]. One study also showed that the individual items addressing walking capacity from both the PF Scale (Item 1) and the ODI (Item 4) are valid and reproducible for this purpose [11]. Previous studies have also shown the PF Scale and ODI to be sufficiently responsive to detect clinically significant changes in patient satisfaction and global clinical status [6,9,14–16]. However, the ability of these questionnaires to detect actual changes in measured walking capacity has not been examined. If these questionnaires are being used to measure walking capacity, it is very important to know how sensitive they are to changes in walking capacity, as measured objectively.

There are two ways to determine the ability of a measure to detect change, and both are components of validity. The ability of a measure to detect clinically meaningful change is known as responsiveness. This implies that there exists an external measure that is valid for assessment of clinically meaningful change. Generally, a global change score of patient-perceived change or satisfaction is used. However, if available, observable physical findings have a long-standing preference over self-reported measures for assessing patient outcomes [17]. When an objective gold standard measure of a construct is available, sensitivity to change can be examined as an element of construct validity. The correlation between change in a given measure and change in the gold standard represents the ability of the chosen measure to detect change in the construct over time. This type of analysis has been termed longitudinal construct validity [17]. If longitudinal data include an objective gold standard measure of walking capacity and a related global change score, both responsiveness to change, using the global change score as the external criterion, and sensitivity to change (longitudinal construct validity), using the objective criterion measure, can be determined. To date, no studies of which we are aware have examined the responsiveness or longitudinal construct validity of measures of walking in LSS using an objective test as the external criterion.

Purpose

The primary objective of this study was to examine longitudinal construct validity of the PF Scale, the ODI, and the walking capacity items from these scales, specifically for the assessment of walking capacity in LSS using the objective SPWT as the external standard. The aim was to determine whether these self-reported measures of walking capacity are acceptable substitutes for the reference standard SPWT. A secondary objective was to examine responsiveness of measures of walking using a self-reported walking capacity change scale as the external criterion standard.

Methods

Design

Subjects were prospectively enrolled and retested 2 years after baseline testing.

Patient sample

Subjects were recruited through the clinical practices of three spine specialist surgeons. Inclusion criteria were 45 years of age or older, LSS diagnosed by a spine specialist surgeon, central or combined LSS confirmed on imaging (magnetic resonance imaging/computed tomography), and self-reported LSS-associated walking limitations or symptoms exacerbated by walking (neurogenic claudication). Combined LSS was defined as a combination of central LSS plus lateral recess or foraminal stenosis. Exclusion criteria included surgery for LSS within the prior 12 months or any comorbid condition that would limit walking capacity or make a SPWT medically inadvisable, as judged by the subjects' physician (eg, severe cardiopulmonary, lower extremity musculoskeletal conditions, or peripheral vascular disease). Subjects may or may not have subsequently elected surgery for LSS.

Ethical approval for the study was obtained through the University of Alberta Health Research Ethics Board.

Outcome measures

Self-reported measures

The self-reported measures included the PF Scale and the ODI. The PF Scale was designed to specifically assess walking capacity in LSS and is calculated as the unweighted mean of the five items in the scale [6]. The resulting possible scores of 1 to 4 represent a range from mild to