INTRODUCTION

Age-related degeneration of the spine can reduce intervertebral disk height, ossify spinal ligaments and cause deterioration of the lumbar facet joints. These changes reduce the spinal canal lumen diameter and induce spinal stenosis. Spinal stenosis in the lumbar region causes pain or numbness in the low back and legs. As the disease progresses, ambulation and gait may be impaired. Self-report measures such as the Oswestry Disability Index (ODI), Medical Outcomes Short Form 12 (SF12), and Visual Analog Scales of pain (VAS) are routinely used in the clinical setting to capture data related to lumbar pain symptoms, function and perceived disability. The associations between self-report measures and objective measures of physical function in patients with lumbar spinal stenosis are not well characterized. The purpose of this study was to determine the correlation between ODI, SF12 and VAS scores and temporospatial measures of gait, three-dimensional lumbar range of motion (3D-ROM), and lumbar proprioception. The results of this study will provide evidence from which clinicians can make informed decisions as to which self-reporting measures are associated with lumbar functional status in patients with lumbar spinal stenosis.

METHODS

Patients with symptomatic lumbar spinal stenosis (N=25; age=62±14; 14 women) were enrolled in this study. Each subject completed the ODI, SF12, and VAS (during activity). Gait analysis was then performed using an instrumented walkway (GaitRite®; CIR Systems, Inc.; Havertown, PA). Three trials of each subject walking at a self-selected pace were collected and the temporospatial parameters were averaged together for analysis. Lumbar 3D-ROM was measured using an electromagnetic tracking system (Liberty, Polhemus Inc, Colchester, VT). Sensors were placed on L1 and L5 locations and joint angles were calculated for each of the three anatomical planes. In the 3D-ROM protocol, subjects were instructed to move as far as they could tolerate in flexion, extension, right and left lateral bending, and right and left axial rotation. The maximum envelope of motion in each plane was reported. Lumbar proprioception was measured by having the subject attempt to reproduce a position of lumbar spine angulation that had been previously set by the experimenter (target position). When the subject perceived that the target had been reached, the lumbar angulation was measured and compared to the actual target position. The difference between the target position and the subjects attempted repositioning is the repositioning error (RE). Linear regression was performed to determine the correlation between self-report scores and gait analysis parameters (specifically stride length, cadence, and velocity).

RESULTS

The ODI was strongly correlated with stride length ($r^2=0.58$, $p<0.05$) and gait velocity ($r^2=0.70$, $p<0.05$) and weakly correlated with cadence ($r^2=0.18$, $p=0.042$). The SF12 was weakly correlated with stride length ($r^2=0.182$, $p=0.042$), but had no correlation with cadence or gait velocity. VAS was weakly correlated with velocity ($r^2=0.189$, $p=0.038$), and cadence ($r^2=0.177$, $p=0.045$), but had no correlation with stride length. There was no significant correlation between lumbar 3D-ROM or proprioception and any of the self-report measures.
Figure 1. Oswestry Disability Index (ODI) and gait velocity were significantly correlated ($r^2 = 0.5062$, $p=0.000929$), with faster velocity being associated with less disability (lower ODI score).

Figure 2. Oswestry Disability Index (ODI) and step length were significantly correlated ($r^2 = 0.5788$, $p=0.000246$), with longer step lengths being associated with less disability (lower ODI score).

Figure 3. Oswestry Disability Index (ODI) and base of support were significantly correlated ($r^2 = 0.3628$, $p=0.00817$), with a narrower base of support being associated with less disability (lower ODI score).

DISCUSSION

Compared with SF12 and VAS, the ODI may be useful in the clinical setting to estimate the patient’s walking ability. The lack of associations between the SF12 and VAS and walking ability was likely due to the non-specificity of these tools for back pain. The ODI content has some questions that relate directly to the functional tests, such as walking and pain during body motion and this may in part explain the higher correlations observed between gait and the ODI relative to the other tools.

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DISCLOSURE STATEMENT

The authors have no conflicts of interest to report.