J. Phys. Ther. Sci. 28: 2094–2096, 2016

The Journal of Physical Therapy Science

Original Article

Differences in performance on the functional movement screen between chronic low back pain patients and healthy control subjects

Min-Joo Ko, PT, MS[1)], Kyung-Hee Noh, PT, PhD[2)], Min-Hyeok Kang, PT, PhD[3)], Jae-Seop Oh, PT, PhD[4)*]

[1)] *Department of Rehabilitation Science, Graduate School, Inje University, Republic of Korea*
[2)] *Busan Sling Exercise Center, Republic of Korea*
[3)] *Department of Physical Therapy, Graduate School, Inje University, Republic of Korea*
[4)] *Department of Physical Therapy, College of Biomedical Science and Engineering, Inje University: 607 Obang-dong, Gimhae-si, Gyeongsangnam-do 621-749, Republic of Korea*

Abstract. [Purpose] Differences in scores on the Functional Movement Screen between patients with chronic lower back pain and healthy control subjects were investigated. [Subjects and Methods] In all, 20 chronic lower back pain patients and 20 healthy control subjects were recruited. Chronic lower back pain patients and healthy controls performed the Functional Movement Screen (deep squat, hurdle step, inline lunge, shoulder mobility, active straight leg raise, trunk stability pushup, and rotary stability). The Mann-Whitney test was used to analyze differences in Functional Movement Screen scores between the two groups. [Results] Chronic lower back pain patients scored lower on the Functional Movement Screen total composite compared with healthy control subjects. Chronic lower back pain patients scored lower on Functional Movement Screen subtests including the deep squat, hurdle step, active straight leg raise, and rotary stability tests. [Conclusion] The deep squat, hurdle step, active straight leg raise, and rotary stability tasks of the Functional Movement Screen can be recommended as a functional assessment tools to identify functional deficits in chronic lower back pain patients.

Key words: Functional Movement Screen, Functional assessment, Chronic lower back pain

(This article was submitted Feb. 15, 2016, and was accepted Apr. 7, 2016)

INTRODUCTION

Chronic lower back pain (CLBP) is a common musculoskeletal disorder and a major source of global disability[1)]. Lower back pain affects the mobility of the lumbar spine and adjacent joints, leading to functional disabilities[2)]. Therefore, understanding CLBP and designing a functional assessment for CLBP are clinically important. Evaluation of CLBP patients can be performed by several objective and subjective evaluation tools. Currently, the Oswestry Disability Index (ODI), Roland-Morris Disability Questionnaire, and Visual Analog Scale (VAS) are the main subjective tools used to determine the degree of disability[3, 4)]. The most commonly used objective tools for evaluating CLBP patients are measures of spine mobility, aerobic capacity, and trunk strength based on rating scales[5, 6)]. However, to date, there is still no functional assessment tool for evaluating the complicated and variable elements of functional movement in CLBP patients.

The Functional Movement Screen (FMS) is a comprehensive examination that assesses seven different fundamental movements previously identified as the foundation for more advanced and dynamic movements. In a preliminary study, FMS scores of 14 or lower were associated with an up to four-fold increased risk of lower extremity injury in female athletes[7)]. In another study, significantly lower preseason FMS scores were reported for athletes who were injured during the season[8)].

*Corresponding author. Jae-Seop Oh (E-mail: ysrehab@inje.ac.kr)

The FMS is designed to challenge the interaction of kinetic chain mobility and stability, which is necessary to perform fundamental and functional movement patterns[9, 10]. Therefore, the FMS may be a useful tool for identifying movement deficits in CLBP patients, who tend to show decreased mobility, core stability, and coordination[11]. However, no study has examined FMS in CLBP patients. Therefore, we investigated differences in FMS scores between CLBP patients and healthy control subjects with the goal of using the FMS as a possible evaluation tool for identifying functional deficits of CLBP in patients.

SUBJECTS AND METHODS

Twenty CLBP patients (17 females and 3 males; mean age, 42.20 ± 14.66 years; mean height, 162.10 ± 7.44 cm; mean weight, 59.75 ± 9.93 kg; mean VAS score, 5.70 ± 1.75) and twenty healthy control subjects (17 females and 3 males; mean age, 43.20 ± 14.41 years; mean height, 160.75 ± 7.40 cm; mean weight, 56.70 ± 9.93 kg; mean VAS score, 0.25 ± 0.44) participated in this study. The control group included individuals who were asymptomatic with respect to musculoskeletal disorders, dizziness, and balance disorders during the period 12 months before participation in this study. The patient group included individuals who had suffered from CLBP sufficient to cause difficulty in their work and everyday life for a period of more than 3 months. All participants signed an informed consent form approved by the Institutional Research Review Committee of Inje University prior to participation in this study.

The FMS, initially described by Cook et al.[9, 10], comprises seven movement tasks and three clearance screens. The movement tasks include the deep squat, hurdle step, inline lunge, shoulder mobility, active straight leg raise (ASLR), trunk stability pushup, and rotary stability. Five of the seven tasks (hurdle step, inline lunge, shoulder mobility, ASLR, and rotary stability) are performed on both the right and left sides. In addition to the movement tasks, three clearance screens are used to assess the presence of pain with shoulder internal rotation/flexion, end-range spinal flexion, and end-range spinal extension.

The protocol for scoring is as follows. If the movement task is performed perfectly, a score of 3 is awarded. If completion of the task requires compensatory movement or if the task cannot be completed, a score of 2 or 1, respectively, is awarded. If the subject feels pain during any movement task, a score of 0 is awarded.

The total composite score and individual task scores were calculated, and the Mann–Whitney test was used to determine differences in the performance of functional movement tasks between the CLBP and control groups. The PASW Statistics software (ver. 18.0; SPSS, Inc., Chicago, IL, USA) was used for statistical analysis.

RESULTS

There were no significant differences in the age ($p=0.829$), height ($p=0.569$), and weight ($p=0.325$) between CLBP patients and healthy control subjects. The CLBP patients had significantly higher VAS scores than the healthy control subjects ($p<0.001$). CLBP patients scored significantly lower on total composite scores compared with the control group (10.95 ± 2.2 vs. 14.40 ± 1.8 points, respectively; $p<0.001$). Two CLBP subjects scored 0 on tests due to back pain. One subject scored 0 during the deep squat and inline lunge tests, while another subject scored 0 during the trunk stability push-up test. CLBP patients also had significantly lower scores on the following individual FMS tasks: deep squat (1.55 ± 0.7 vs. 2.20 ± 0.5 points, $p=0.002$), hurdle step (1.95 ± 0.4 vs. 2.45 ± 0.5 points, $p=0.002$), ASLR (1.85 ± 0.7 vs. 2.55 ± 0.8 points, $p=0.005$), and rotary stability (1.15 ± 0.4 vs. 1.80 ± 0.4 points, $p<0.001$). However, no significant differences between CLBP patients and the control group were found on the following individual FMS tasks: inline lunge (1.90 ± 0.7 vs. 2.25 ± 0.7 points, $p=0.133$), shoulder mobility (1.75 ± 0.9 vs. 1.85 ± 0.6 points, $p=0.811$), and trunk stability push-up (0.95 ± 0.5 vs. 1.30 ± 0.6 points, $p=0.056$).

DISCUSSION

CLBP patients scored lower on several specific FMS tasks namely, the deep squat, hurdle step, ASLR, and rotary stability, compared with the healthy control subjects.

CLBP patients' low scores on the deep squat task can be explained by the restricted knee, ankle, and hip joints that are common in CLBP patients due to limited lumbar and hip joint mobility[12]. In addition, patients with chronic mechanical lower back pain have decreased ankle dorsiflexion range of motion (ROM), although they do not have flatter feet[13]. The hurdle step task requires proper stability and coordination between the hips and torso during the stepping motion, which was expected to be lacking in CLBP patients. The low scores of the CLBP patients on the hurdle step task confirm that spine and hip mobility are restricted in CLBP[10]. The CLBP patients also performed poorly relative to healthy controls in the ASLR and rotary stability tasks. These tasks are accompanied by lower or upper extremity movement. Shoulder flexion induces anterior displacement of the center of mass, placing greater demands on the trunk muscles to keep the center of mass over the base of support[14, 15]. Therefore, trunk stability is needed to maintain the neutral position. However, previous studies have shown that patients with back pain have difficulty properly recruiting the trunk stability muscles before moving the limbs, as is required for movements such as the ASLR[16]. Thus, compensation may occurr in CLBP patients during ASLR and rotary stability tests due to inappropriate recruitment of the trunk stability muscles, leading to lower scores among CLBP patients relative to healthy controls. In this study, two CLBP patients scored 0 in the FMS tests. Generally, CLBP patients have limited hip range

of motion, which is related to lumbar instability causing pain[17]. Thus, it is possible that pain caused by limited hip range of motion led to these patients scoring 0 in the present study.

Several limitations have to be considered. First, we did not recruit many subjects of different ages among the CLBP patients and healthy controls. Second, we did not directly measure intrinsic factors such as muscle activation, neuromuscular control, and core stability.

ACKNOWLEDGEMENT

This research was supported by Basic Science Research Program through the National Research Foundation of Korea (NRF) funded by the Ministry of Education (No. 2015R1D1A1A01056853).

REFERENCES

1) Hoy D, March L, Brooks P, et al.: The global burden of low back pain: estimates from the Global Burden of Disease 2010 study. Ann Rheum Dis, 2014, 73: 968–974. [Medline] [CrossRef]
2) Wong TK, Lee RY: Effects of low back pain on the relationship between the movements of the lumbar spine and hip. Hum Mov Sci, 2004, 23: 21–34. [Medline] [CrossRef]
3) Roland M, Fairbank J: The Roland–Morris disability questionnaire and the Oswestry disability questionnaire. Spine, 2000, 25: 3115–3124. [Medline] [CrossRef]
4) Han GS, Cho MH, Nam GT, et al.: The effect on muscle strength and viual analog scale pain of aquatic therapy for individuals with low back pain. J Phys Ther Sci, 2011, 23: 57–60. [CrossRef]
5) Kishi S, Morikita I: Range of motion of hip joints of male university kendo practitioners with lower back pain. J Phys Ther Sci, 2009, 21: 253–256. [CrossRef]
6) McQuade KJ, Turner JA, Buchner DM: Physical fitness and chronic low back pain. An analysis of the relationships among fitness, functional limitations, and depression. Clin Orthop Relat Res, 1988, (233): 198–204. [Medline]
7) Chorba RS, Chorba DJ, Bouillon LE, et al.: Use of a functional movement screening tool to determine injury risk in female collegiate athletes. N Am J Sports Phys Ther, 2010, 5: 47–54. [Medline]
8) Letafatkar A, Hadadnezhad M, Shojaedin S, et al.: Relationship between functional movement screening score and history of injury. Int J Sports Phys Ther, 2014, 9: 21–27. [Medline]
9) Cook G, Burton L, Hoogenboom B: Pre-participation screening: the use of fundamental movements as an assessment of function - part 1. N Am J Sports Phys Ther, 2006, 1: 62–72. [Medline]
10) Cook G, Burton L, Hoogenboom B: Pre-participation screening: the use of fundamental movements as an assessment of function - part 2. N Am J Sports Phys Ther, 2006, 1: 132–139. [Medline]
11) Ulane CM: Evaluation and management of back pain in the elderly. Curr Geriatr Rep, 2015, 4: 117–123. [CrossRef]
12) Shum GL, Crosbie J, Lee RY: Effect of low back pain on the kinematics and joint coordination of the lumbar spine and hip during sit-to-stand and stand-to-sit. Spine, 2005, 30: 1998–2004. [Medline] [CrossRef]
13) Brantingham JW, Lee Gilbert J, Shaik J, et al.: Sagittal plane blockage of the foot, ankle and hallux and foot alignment-prevalence and association with low back pain. J Chiropr Med, 2006, 5: 123–127. [Medline] [CrossRef]
14) Kang MH, Jang JH, Kim TH, et al.: Effects of shoulder flexion loaded by and elastic tubing band on EMG activity of the gluteal muscles during squat exercises. J Phys Ther Sci, 2014, 26: 1787–1789. [Medline] [CrossRef]
15) Hodges PW, Richardson CA: Altered trunk muscle recruitment in people with low back pain with upper limb movement at different speeds. Arch Phys Med Rehabil, 1999, 80: 1005–1012. [Medline] [CrossRef]
16) Lee SH, Kim TH, Lee BH: The effect of abdominal bracing in combination with low extremity movements on changes in thickness of abdominal muscles and lumbar strength for low back pain. J Phys Ther Sci, 2014, 26: 157–160. [Medline] [CrossRef]
17) Lee SW, Kim SY: Effects of hip exercises for chronic low-back pain patients with lumbar instability. J Phys Ther Sci, 2015, 27: 345–348. [Medline] [CrossRef]