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Original Article

Relationship between the thoracolumbar flexion angle and pelvic posterior movement during trunk flexion

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Abstract. [Purpose] The purpose of this study was to investigate the linear relationship between the thoracolumbar flexion angle and hip posterior displacement. [Subjects and Methods] This study was performed on 15 subjects. The subjects performed three trials of a lumbar flexion–extension task. To quantify the statistical linear relationship between the thoracolumbar flexion angle and hip posterior displacement, Spearman's rank correlation coefficient was used. [Results] The thoracolumbar flexion angle was significantly correlated with the degree of hip posterior displacement. [Conclusion] According to the results of this study, movement of the thoracolumbar joint and posterior movement of the pelvis must be considered for accurate analysis of the lumbopelvic rhythm.
Key words: Linear relationship, Lumbopelvic rhythm, Thoracolumbar flexion

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INTRODUCTION

Internet and computer use rates among Korean households have rapidly increased since 2000, and Korea has now been identified as having the highest distribution of Internet and computers in the world[1)]. In modern society, computer-based work is clearly a major cause of low back pain (LBP)[2)]. The thoracolumbar junction, which joins the thoracic spine and the lumbar spine, comprises the vertebral column from the eleventh thoracic vertebra to the first lumbar vertebra[3)]. Here, spinal curvature changes from kyphosis to lordosis, and the orientation of the facet joints changes from coronal to sagittal[3)]. Sitting for a long period of time places stress on the lumbar region, reduces blood circulation in the lower extremities, and may result in muscle shortening, muscle weakness, or hypomobility of the joints[3, 4)]. Recently, an association between LBP and prolonged posture, specifically, prolonged sitting, has been reported[5)]. Remaining seated for long periods of time can cause specific problems in the spine, circulation, muscles, and joints[2)]. Elgueta-Cancino et al. suggested that the preliminary study of concurrent and discriminant validity of the test provides a foundation to further investigate its utility to characterize thoracolumbar movement patterns in individuals with LBP[6)]. Therefore, the purpose of this study was to investigate the linear relationship between the thoracolumbar flexion angle and hip posterior displacement.

SUBJECTS AND METHODS

This study was performed on 15 subjects (9 females and 6 males) aged 23.6 ± 2.0 years (mean ± SD); the mean height and weight were 157 ± 4.3 cm and 61.5 ± 5.2 kg, respectively. The purpose and methods of the study were explained to the subjects, and written informed consent was obtained in keeping with the ethical principles of the Declaration of Helsinki. The subjects were instructed to stand with their arms hanging freely by their sides and their feet spaced slightly apart. They were

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then asked to maintain an upright standing position for 5 seconds (re-standing phase). After practicing a lumbar flexion–extension task, the subjects performed three trials of a task involving following a metronome, and the mean of the three trials was used for data analysis. The movement of each subject was videotaped using a single video camera. The thoracolumbar flexion angle was measured as the angle between a line from the T9 spinous process to the T12 spinous process, and a line from the T12 spinous process to the L2 spinous process. Hip posterior displacement was measured as the posterior horizontal displacement distance of the greater trochanter. The thoracolumbar flexion angle and hip posterior displacement were measured and recorded by a digital camera, and the video motion analysis software Pro-trainer (ver. 10.1; Sports Motion, Cardiff, CA, USA) was used to analyze the kinematic data. Pro-trainer software is a tool with a complete range of features including digital video capture at up to 1,200 frames-per-second, slow-motion playback, freeze-frame analysis and extensive graphics tools. To quantify the statistical linear relationship between the thoracolumbar flexion angle and hip posterior displacement, Spearman's rank correlation coefficient was used. An a priori α level of 0.01 was set to indicate statistical significance.

RESULTS

The thoracolumbar flexion angle (17.4 ± 7.24°) was significantly correlated with the degree of hip posterior displacement (7.6 ± 3.3 cm) (r=−0.81, $p<0.01$).

DISCUSSION

The facet joints of the thoracic spine allow for flexion, extension, and lateral flexion of the spine[3]. However, the shape of the facet joint changes gradually at the lower part of the thoracic spine to one that locates the facets in the midsagittal plane, as in the lumbar spine[3]. Proper movement of the thoracolumbar joint produces full flexion of the lumbar spine[3, 4]. These movements may help to flex the sides of the sieve, which minimizes the bending moment resulting from the curvature of the stem[4]. The resulting reduction in motion of the thoracolumbar joint is believed to result in the formation of a body in the back of the body by moving the pelvis to the back of the body, making it easier to move the pelvis to the back of the body. This has a negative effect on the normal lumbopelvic rhythm. Backward movement of the pelvis may reduce the articulation of the joint, resulting in abnormal stress on the hip. Trunk flexion–extension is used for assessing the spine[5]. Measurement of the angle between the two sides focuses on the spinal processes of the two joints, as well as lumbar flexion and pelvic forward flexion[4, 5]. However, according to the results of this study, movement of the thoracolumbar joint and posterior movement of the pelvis must be considered for accurate analysis of the lumbopelvic rhythm. Pelvic posterior movement occurring during trunk flexion is normal, but it is important to differentiate between normal and abnormal posterior movement of the pelvis. Even if the normal range of articulation is reached, such posterior movement may result in cumulative damage if the various joints show an imbalance. The results of this study indicate that proper thoracolumbar joint flexion range facilitates normal lumbopelvic rhythm and decreases stress on the hip joints during trunk flexion.

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Conflict of interest

None.

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