Comparison of Buttock Pressure and Pelvic Tilting Angle During Typing in Subjects With and Without Unilateral Low Back Pain

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Abstract

Asymmetric sitting posture may cause asymmetric buttock pressure and unilateral low back pain (LBP). The purpose of this study was to compare the differences of buttock pressure between both sides, and pelvic angle (sagittal and coronal planes) during typing in a sitting position on a pressure mat (Baltube) in individuals with and without unilateral LBP. Ten subjects with unilateral LBP and ten subjects without unilateral LBP were recruited for this study. Buttock pressure was measured using a pressure mat and pelvic angles were measured using a palpation meter. The subjects performed typing in a sitting posture for 30 minutes. Pressure data were collected and averaged at initial term (from start to first minutes) and final term (last minutes of 30 minutes). Angles of pelvic tilting were measured after 30 minutes typing. Pressure asymmetry values (difference in pressure between both sides) were calculated at the initial and final terms. A two way analysis of variance was used to compare the differences between the initial and final pressure asymmetry values in subjects with and without unilateral LBP. An independent t test was applied to compare the pelvic tilt angles between the two groups. To compare the change of pressure from the initial term to the final term between the symptomatic and asymptomatic sides in the unilateral LBP group, a paired t-test was applied. In the unilateral LBP group, the pressure asymmetric value at the final term was significantly greater than that of the initial term (p<.05). The angle of pelvic tilting in coronal plane was significantly greater in the unilateral back pain group compared to the without unilateral LBP group (p<.05), however, there was no significant difference in the angle of pelvic tilting in the sagittal plane between the two groups (p>.05). In the unilateral LBP group, the change of pressure from the initial term to the final term was significantly less in the symptomatic side (6.90 mmHg) than the asymptomatic side (5.10 mmHg). This asymmetric sitting posture may contribute to unilateral LBP in the sitting position. Further studies are needed to determine if asymmetric weight bearing in sitting causes unilateral LBP or if unilateral back pain causes asymmetric weight bearing, and if the correction of asymmetric weight bearing in sitting can reduce unilateral LBP.

Key Words: Buttock pressure; Pelvic tilting angle; Sitting posture; Typing; Unilateral low back pain.

Introduction

The prevalence and incidence of musculoskeletal disorders have increased in computer workers (Aarás et al, 1997. Watanabe et al, 2007). Studies conducted by the National Institute for Occupational Safety and Health proved that 20.25% of 1,000 computer workers felt continuous discomfort in the back area (Sauter et al, 1991). Low back pain (LBP) has been linked to asymmetrical sitting posture and pelvic positions.
(Al-Eisa et al, 2004; Grundy and Roberts, 1984; Knutson 2002). Pelvic asymmetry is a commonly reported aggravating factor for LBP (Dankaerts et al, 2006; Vergara and Page, 2002; Williams et al, 1991; Womersley and May, 2006) and sitting position has been considered as individual sitting posture (Dankaerts et al, 2006). It is a commonly viewed that pelvic asymmetry contributes to secondary altered alignment in the lumbar spine, like scoliosis (Riegger-Krugh and Keysor, 1996). Altered alignment shows as a lateral curve that involves various degrees of vertebral rotations as well. Commonly, it is this secondary alterations that are assumed to lead to LBP and contribute to secondary structural alterations in the spine (McCaw and Bates, 1991). Pelvic asymmetry is generally related to sacroiliac joint dysfunction, and abnormal alignment between the right and left innominate bones on the sagittal plane, specifically, iliac rotation asymmetry (Egan et al, 1996).

Pelvic asymmetry also causes kinematic changes in the spine and may affect vertebral disks. Nachemson (1975) studied the disparity in the compressive force on the disks in various positions. Compression influences the disks, the facet joints and alignments. The effect of compression is not concrete to any diagnosis or category but should be considered a factor in the impairment movement of LBP patients.

Lee and Yoo (2011) measured the pressure between the seat and the gluteus using the Tekscan system (Tekscan Inc., South Boston, MA, USA) to investigate the change of gluteal pressure by crossed leg sitting position, and they reported that crossed leg sitting causes asymmetric buttock pressure. In other studies, Park and Yoo (2011) administered pressure biofeedback to frequent computer users using a posture-sensing air seat device for monitoring trunk movements and they reported that a posture-sensing air seat device can reduce trunk and lateral flexion. But this study did not directly measure buttock pressure and pelvic angles. There was comparison of erector spinae muscle volumes at the L5-S1 levels and multifidus muscle volumes at the L4 and S2-3 levels of cross sectional area with and without unilateral low back pain (Beneck and Kulig, 2012) and they reported that the LBP group had an 18.1% reduction in muscle volume at the L5-S1 levels, but no pain and non-pain side interaction effect was identified.

Previous studies that measured buttock pressure in the sitting position used Tekscan in normal healthy subjects (Lee and Yoo, 2011). Although previous literature postulated that asymmetric sitting posture may contribute to unilateral back pain (Park and Yoo, 2011), there have been no studies that have investigated asymmetric weight bearing in individuals with unilateral LBP.

The purposes of this study were (1) to compare differences of buttock pressure between both sides in subjects with and without unilateral LBP, (2) to compare the pelvic tilting angles in subjects with and without unilateral LBP after 30 minutes of computer typing, and (3) to compare the change of buttock pressure from the initial term to the final term between the symptomatic and asymptomatic sides in subjects with unilateral LBP. It was hypothesized that the unilateral LBP group would demonstrate greater asymmetric buttock pressure and pelvic tilting angle compared to the without LBP group. It was also hypothesized that the change of buttock pressure in the symptomatic side would be less than in the asymptomatic side in subject with unilateral LBP.

Methods

Subjects

Sample size was calculated in this study for G*power analysis. By utilizing G*power 3.1.2 software (Franz Faul, University of Kiel, Kiel, Germany) in a pilot study of 16 subjects, an effect size of 4 was confirmed (calculated by partial $\eta^2$ of .78 at an