DOES THE DEVELOPMENT OF TRANSIENT LOW BACK PAIN AFFECT POSTURAL CHANGES DURING PROLONGED STANDING?

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INTRODUCTION

Asymptomatic individuals have been previously shown to clearly separate into low back pain (LBP) developer (PD) and non-pain developer (NPD) groups during a 2-hour bout of prolonged standing, with reports of 40-70% of subjects being characterized as PD[1-3]. Co-contraction of both the bilateral gluteus medius muscles[1-3] and trunk flexor-extensor muscle groups[1] has been shown to be elevated in PD during prolonged standing. This co-contraction may induce a “frozen” posture, which will prevent PD from performing both conscious (body weight shifts) and unconscious (center of pressure patterns) postural changes when standing for extended periods of time. These postural changes have been hypothesized to occur as a mechanism to reduce fatigue and discomfort while standing. The purpose of this study was to examine the relationship between postural changes and the subjective reporting of LBP during a 2-hour prolonged standing occupational simulation. It was hypothesized that PD and NPD would show different amplitudes and frequencies of postural changes and that these would change over time.

METHODS

Forty-one subjects (20 male, 21 female) were recruited from the University of Waterloo student population. Exclusion criteria included any prior history of LBP requiring medical treatment or resulted in more than three days off work/school, previous hip surgery, inability to stand for greater than two hours, and having an occupation that required prolonged standing.

Participants completed a 2-hour prolonged standing protocol on a level surface. Each participant rated their discomfort on a visual analog scale (VAS) when they entered the lab on collection day and every 15 minutes during the standing protocol. The VAS score was used to classify each participant as a PD or NPD. Two force plates were used to separately measure the ground reaction forces under the left and right foot (sampled at 1024 Hz) and the center of pressure (COP) was calculated under each foot.

Left foot COP shift, fidget, and drift patterns were defined for both the anterior-posterior and medial-lateral center of pressure using the methods of Duarte and Zatsiorsky[4]. Body weight (BW) shifts were defined using the vertical ground reaction force under the left foot. Symmetrical stance was defined as between 50±15% of their BW supported by the left leg. When the subject placed greater than 65% of their BW on their left leg, the stance was defined as asymmetrical and a shift onto their left leg, while below 35% supported by the left leg signified a shift onto the right leg. A shift was counted each time the subject passed either of the asymmetrical thresholds.

The 2-hour protocol was segmented into eight 15-min blocks. COP (shift, drift, fidget frequency and amplitude) and BW shift (frequency, duration, total time in an asymmetrical stance, and shifts onto the left leg) outcome measures were entered into a three-way linear model with between factors of gender and pain group (PD/NPD) and a repeated measure within factor of time (eight blocks) (significance of \(p<0.05\)).

RESULTS AND DISCUSSION

Thirty-two percent of participants developed low back pain in this study (four male, nine female). BW shift frequency increased \((p<0.0001)\) and average shift duration decreased \((p=0.0006)\) over the 2-hour protocol (Figure 1), which was independent of pain group. Interestingly, the
changes in both of these variables occurred up until the VAS scores of the PD began to increase[1]. After this point, both variables began to level off for the remainder of the protocol.

![Figure 1: BW shift frequency (solid) & duration (dashed). The vertical dashed line represents the time of initial VAS score increase for PD[1].](image)

Although it was hypothesized that the increased bilateral gluteus medius co-contraction would prevent PD from shifting during the standing protocol, very few differences were shown between the two groups. This is similar to previous literature looking at chronic low back pain patients and healthy individuals during a 30-min unconstrained standing protocol[5].

Although the two groups show similar postural changes, the mechanisms driving these changes may not be the same between the pain groups. As a result, PD may not receive the fatigue relieving effects that these postural changes potentially provide to NPD. The mechanisms utilized by the PD group resulting in bilateral co-contraction may be an inefficient or an aberrant motor control pattern, and as a result, cause pain and discomfort.

**CONCLUSIONS**

Few differences were found between two pain groups, with male PD varying the most from the other three groups. Co-contraction did not prevent the PD from shifting into an asymmetrical stance; however, these subjects might have used an inefficient or aberrant motor control pattern to drive these shifts. Future work should look at how mechanisms during quiet standing are altered before and after a prolonged standing and whether an exercise intervention can alter any of these strategies, especially for the male PD.

**REFERENCES**


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