Determining the effect of four standing rest-break conditions on self-report low back pain and mental fatigue and productivity during prolonged sitting in back-healthy individuals

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1. Introduction

Low back pain (LBP) is the second leading cause of disability worldwide and occurs at an incidence of 60-90\% in the general population (Andersson, 1999). Estimates of the per annum cost of LBP range from $25 billion to $100 billion in the USA alone (Frymoyer & Cats Baril, 1991). Though various types of LBP exist, back-healthy individuals will become pain developers (PD) within a two-hour time frame during prolonged sitting and standing. Given that 40-70\% of the population will become acute PD (Gallagher, Callagahn & Campbell, 2014), the need for an effective yet simple intervention is warranted in the workplace. Previous literature has suggested exercise as a possible remedy to reduce self-report LBP (Nelwon-Wong, 2009). Exercise, however, is not always an effective and feasible intervention as it relies highly on employee motivation and participation as well as employer approval. Ultimately, a more practical method for reducing acute pain is warranted.

2. Methods

Ten male and ten female, back-healthy individuals were recruited from the university population (mean weight = 72.4kg, mean height = 1.74m). Subjects completed four hour-long bouts of seated typing. Each bout of typing employed a unique standing rest-break sequence: condition A – no rest; condition B – 5 minutes of rest every 30 minutes; condition C – 2.5 minutes of rest every 15 minutes; condition D – 50 seconds of rest every 5 minutes. Self-report LBP and mental fatigue were collected every 10 minutes using a 100mm visual analogue scale. The first collection occurred at baseline. Productivity, as measured in adjusted words per minute, was collected at the end of each typing session. PD were separated from non-pain developers (NPD) based on an increase in 10 units of self-report LBP by the end of condition A, when compared to baseline time. During each standing rest break subjects were instructed to stand in the middle of the room and could converse with the researcher or use their mobile phone.

3. Results

Eight of 20 subjects (40\%) were sub-classified into PD. A significant effect was observed for group for condition A, where PD reported lower LBP than NPD (mean = 1.28) than NPD (mean = 6.76). Two separate repeated measures analyses of variance for LBP and mental fatigue were run with repeated factors of time and condition and a between subjects factor of group for PD and NPD.

\textbf{Self report LBP} (figure one): A significant main effect was observed for time: F (2.08, 37.56) = 29.80, p<.001; time and group interaction: F (2.08, 37.56) = 10.60, p<.001; condition and time interaction: F (5.68, 102.18) = 5.52, p<.001; and the condition, time and group interaction: F (5.67, 102.18) = 6.18 p<.001.

\textbf{Self report mental fatigue} (figure two): A significant main effect was observed for condition: F (3.00, 54) = 6.61, p<.005; time: F (2.02, 36.35) = 14.53, p<.001; and the condition and time interaction: F (8.17, 147.06) = 3.30 p<.005.

\textbf{Productivity}: No significant differences in productivity were observed across conditions or between groups.
4. Discussion

Previous research has suggested the minimum time for onset of acute LBP is two hours. Our research suggests that a one-hour bout of prolonged sitting is enough time for acute PD to develop significant changes in self-report LBP. The greatest reduction in LBP for PD was observed in condition D, however PD and NPD did not prefer this microbreak condition, as indicated in an exit survey. Furthermore, condition A resulted in the greatest increases in mental fatigue for PD and NPD. Therefore, our recommendation to PD is to break every 30 minutes for 5 minutes of standing rest. Lastly, our findings indicate that a small-scale intervention such as taking a standing rest break from work is an effective treatment for acute LBP in PD populations.

Figure 1 - Results of self-report LBP for PD and NPD (letters in bottom left corners coincide with Conditions A, B, C and D, respectively). Shaded grey areas represent standing rest breaks; solid grey line represents PD, dotted grey line represents NPD, black line represents average of all participants. * Indicates statistically significant difference for PD for specified time interval compared to time 0. ** Indicates statistically significant difference between PD and NPD for same time interval.
Figure 2 - Results of self-report mental fatigue based on Condition and Time. Asterisks indicate significant difference from time zero for corresponding condition (*Condition A, **Condition B, ***Condition C, **** Condition D), and + indicates a significant difference between baseline mental fatigue ratings between Condition A and D.

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References