The Effect of Attentional Focus on Trunk Control during a Repetitive Flexion Task

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INTRODUCTION

To safely bear loads and reduce the risk of low back injury, individuals need to appropriately control the movements of their spine [1]. In the motor control literature, it has been shown that people's focus of attention (FOA) can affect their neuromuscular control, altering task accuracy and performance. Specifically, motor control differences have been seen when individuals focus on their body movements (i.e. internally) versus when they focus on the effect of their movement (i.e. externally). However, there is uncertainty within the literature, with some tasks appearing to benefit from an external FOA (e.g. golf [2], balance [3] and supra-postural tasks [4]), while other tasks are unaffected (e.g. gait local dynamic stability [5]).

The uncertainty of whether FOA affects all movements raises concern regarding trunk motor control, which is often measured through local dynamic stability (LDS) calculations from repetitive spine flexion tasks (e.g. [6]). If FOA does have an effect on trunk motor control, then the reliability of measurements obtained through these protocols can be improved by controlling for FOA. Therefore, the goal of this study was to determine if there are changes in trunk motor control due to the object of a participant's FOA during a repetitive spine flexion task. Based on previous literature demonstrating an effect of FOA across a wide range of activities, it was hypothesized that there would be improvements in spine control when participants focus externally vs. internally.

METHODS

Fourteen healthy adults (7 male and 7 female; 24 years (SD=5), 170.5 cm (SD=8.2), 66.7 kg (SD=12.9)) performed 35 cycles of a repetitive spine flexion task while constrained at the hip. Participants were instructed to touch two buttons, one at shoulder height and the other at knee height to the beat of a metronome (0.5 Hz; 4 seconds/cycle). Participants performed the task under two FOA conditions: external FOA (instruction: focus on touching the button exactly on the beat of the metronome) and internal FOA (instruction: focus on controlling the movement of your trunk between beats of the metronome). Participants indicated on a visual analogue scale (VAS) how much of their attention was focused on their instructions; a score of less than 50% was deemed a mistrial and was repeated. Motion capture data of clusters located over the T_{10}-T_{12} vertebrae and over the sacrum were collected at 120 Hz, which was then imported into Visual 3D (V5, C-motion, MD, USA) to calculate Euler angles of the lumbar spine (i.e. the T_{10}-T_{12} cluster relative to the pelvis cluster). Trunk LDS was then calculated from the sum of squares of the 3D Euler angles, by first creating a 6D state space using the method of delays, and then calculating the maximum local divergent exponent (λ_{max}) using the Rosenstein method [6]. A paired samples T-test (α = 0.05) was used to detect any differences in λ_{max} between FOA conditions.

RESULTS

There was no significant difference in λ_{max} between the internal and external focus conditions (p = 0.202) (Table 1). Participants were able to focus more on what was instructed during the external focus condition compared to the internal focus condition (p = 0.002) (Table 1).

DISCUSSION / CONCLUSIONS

Despite previous studies finding differences in performance and movement quality when an individual's FOA was adjusted, we found no difference in spine control when the participant focused on controlling their trunk movements (i.e. internal FOA) vs. when they were focused on pressing the buttons in synchrony with the metronome beat (i.e. external FOA). Despite these findings, we still recommend providing clear instructions regarding FOA to participants to minimize potential sources of inter-subject variability on LDS results.

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Table 1. Mean values. Participants were able to maintain a similar amount of trunk control between FOA conditions.

Focus Condition	λ_{max} ± SD	VAS score ± SD
Internal	2.11 ± 0.21	74 ± 13%*
External	2.01 ± 0.20	85 ± 10%*

Legend: * significant difference at a critical significance level of $p < 0.05$