How one's focus can affect their posture and balance

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Introduction

It is well researched that when instructions are given to either focus on something external to the body, i.e the effect the movement has (external focus), better performance is observed than when one is instructed to focus on their body's movements (internal focus) (Wulf, Shea & Park, 2001). Postural control has been previously understood to be a relatively automatic skill that requires little attention, and adjustments to balance are said to be small, quick, reflexive actions (Wulf & Prinz, 2001). According to the constrained action hypothesis, when one focuses internally and attempts to actively maintain balance, it intervenes with the inherent motor processes involved with balance, and so, by focusing externally it allows unconscious processes to control the movement or lack thereof (Wulf, McNevin & Shea, 2001).

The purpose of this study was to examine the influence of attentional focus on balance, and the maintenance of posture in healthy older adults over the age of 65. Participants were to perform an external focus task, an internal focus task and a cognitive counting task.

It was hypothesized that the cognitive counting task (CCT) will have center of pressure (COP) measures that show less swaying, which would indicate the best maintenance of posture and balance of the three conditions.

Methods

Participants: 16 elderly participants were tested on the 3 experimental conditions (Table 1). The inclusion criteria consisted of having no history of frequent falls; no lower body injury or recent surgery; the ability to stand upright without support while performing a cognitive task, and no other deficits that might interfere with balance.

Procedures: Participants were asked to stand on a steady AMTI force plate platform, which measured center of pressure (COP) at a sampling frequency of 500 Hz. The participants alternated through three randomly assigned blocked conditions. The conditions consisted of: minimize the movement of the hips (internal focus); minimize the movement of markers placed on the hips (external focus); and lastly focus on a cognitive counting task. Six trials that were one minute in length were completed for each of the 3 conditions. Participants were asked out of 100% how much attention they spent on the focus tasks, if less than 60% the trial was repeated.

Analysis: The force plate data was processed using MATLAB software.COP displacement in the anterior-posterior(AP) and medial-lateral (ML) directions, COP SD in the AP and ML directions, COP Path Length, and 95% Area ellipse (area) measures were calculated for each postural test. Trials were averaged for each experimental condition and using Statistica, a one way ANOVA with repeated measures test was performed, finally a post hoc LSD analysis was executed if significance was observed.

Table 1.
Summary of participants.

Participants	Mean ± SD (years)	n
Male	71.67±6.11	3
Female	72±4.32	13

Results

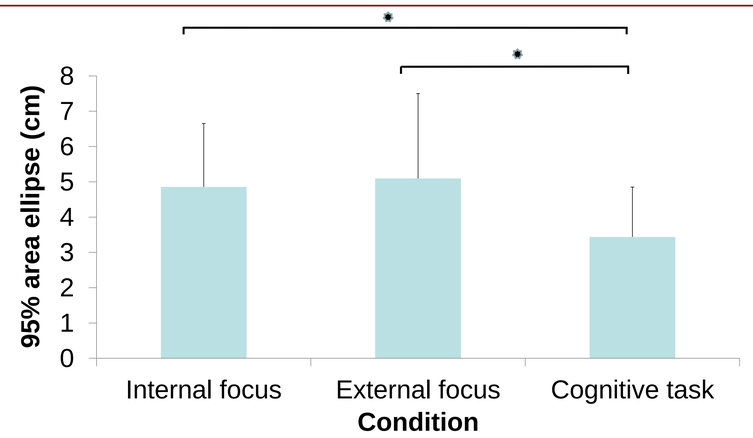

Figure 1. *Results of area in centimeters for the three conditions, n= 16. (* = p<0.01)*

F(2,30) = 10.39, p= 0.00037

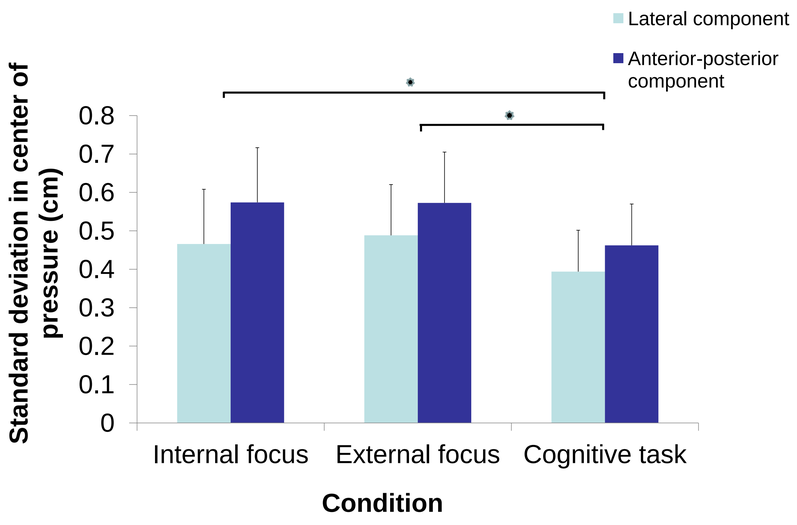

Figure 2. *Results of Standard deviation in center of pressure in the lateral and anterior-posterior components measured in centimeters, n=16.* (* = p<0.01)

Lateral component: F (2,30)= 14.28, p= 0.000044
Anterior-posterior component :F(2,30)= 8.51, p = 0.001185

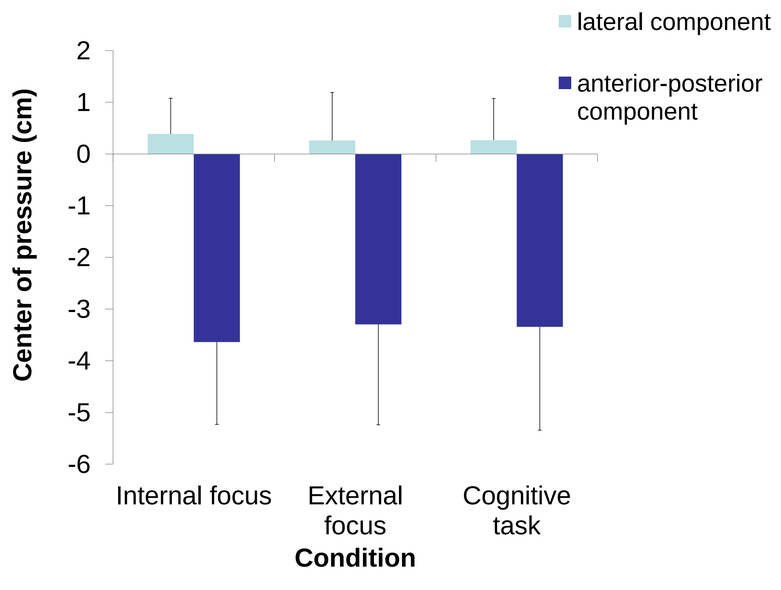

Figure 3. *Results of center of pressure in the lateral and anterior-posterior components measured in centimeters, n=16.*

Lateral component: F(2,30)= 0.36, p=0.7014
Antero-posterior component: F(2,30)=1.49, p=0.2414

Discussion

One may observe that the CCT resulted in significantly ($p<0.01$) lower area than either of the two focus tasks; additionally the CCT also showed significantly ($p<0.01$) lower SD in COP for both the ML and AP components as compared to the two focus conditions. A noteworthy observation was that COP measures for both the ML and AP components showed an insignificant difference ($p>0.01$) between the three conditions, but the CCT showed significant difference when considering area (which is an amalgamation of the COP measures for ML and AP). Other measures such as COP path length and velocity were found to have insignificant ($p>0.01$) differences between conditions.

These results indicate that when a person is focusing on a cognitive task as opposed to an internal or external focus, the individual is less variable in their movements (lower SD in COP) and that there is a smaller area indicating less sway and superior balance. The CCT likely distracted the participants from focusing on their posture resulting in better performance.

These findings are consistent with previous literature which has found that when one shifts deliberate control away from the active maintenance of posture, it causes more automatic postural control, allowing for better postural performance (Bernard-Demanze, Dumitrscu, Jimeno, Borel & Lacour, 2009). Furthermore these results support the constrained action hypothesis which proposes that by actively focusing on posture, it interrupts automatic control processes which would otherwise be regulating the movement (Wulf, Mcnevin, & Shea, 2001).

It is beneficial to know that by having one's mind on other matters it can result in better balance. Research in this area may be expanded to observe elderly populations who are more highly prone to falling - as opposed to those without a history of falling as was performed in this experiment - and the effects a continuous dual task has on posture. The question now becomes: does the experiment's results still apply?

Conclusion

The results of this study support the hypothesis. It was observed that during the cognitive task the area and SD (variability) in COP values were significantly less than the values found in the two focus tasks indicating that there is less swaying occurring and therefore better balance. This is of interest as it highlights a method in which a person may improve their stability. This could be particularly important for aged populations where the risk of falling is larger. The next step is to use these results in the implementation of an intervention program with the aim of teaching at risk individuals that focusing on your movement is not always best for balance.

References

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