The relationship between quasi-static sitting and standing postural stability measures in healthy individuals: A preliminary study

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**INTRODUCTION**
Recent evidences suggest that sitting balance upon admission may accurately predict the ambulatory capacity at discharge from intensive functional rehabilitation among individuals with neurological impairments. However, the link existing between sitting and standing postural stability abilities and sensorimotor regulation mechanisms has not been confirmed to date. The aim of this study was to determine the strength of the association between quasi-static postural stability measures obtained in sitting (supported and unsupported) and standing positions in healthy individuals.

**METHODS**
Fourteen healthy male individuals (age=41.4±13.4yrs; height=1.74±0.07 m; weight=80.1±7.90 kg) volunteered to participate in this study. During a laboratory assessment, they maintained 1) two sitting positions on an height-adjustable instrumented seat with their feet resting on forceplates embedded in the floor, with both hands placed on their thighs \textit{(supported sitting)} and with both shoulders flexed at 70° and abducted at 45° \textit{(unsupported sitting)}; 2) one comfortable standing position on forceplates embedded in the floor, with both upper limbs resting in a comfortable position alongside the body. A total of two 60-second trials were randomly performed for each position. The global reaction force was recorded (600 Hz) to continuously locate the center of pressure (COP) position (Figure 1). The COP time series were low-passed filtered (5 Hz) and re-sampled (300Hz) before analysis.

A total of 17 COP measures based on time- and frequency-domain, as proposed by Prieto et al. [1], were computed from the time and frequency series of the resultant (RD) reaction forces. For 11 out of the 17 COP measures, the anteroposterior (AP) and the mediolateral (ML) components were also assessed separately. A one-way ANOVA was performed to determine if differences existed across positions. Pearson’s correlation coefficients \((r)\) quantified the association of all COP measures between sitting and standing positions. A correlation coefficient above 0.75 was judged strong whereas a correlation coefficient between 0.50 and 0.75 was considered moderate.

**RESULTS**
The majority of COP measures differed between each sitting position and standing positions. Greater displacement, velocity and lower frequency measures were confirmed in RD, as well as AP and ML components, in standing posture compared to the two sitting positions. Interestingly, velocity and COP displacement on ML component did not differ between unsupported sitting and standing position. Moderate correlations in velocity \((r=0.59)\) and COP displacement \((r=0.59)\) on ML direction were also revealed between these two positions. Other COP measures were uncorrelated between sitting and standing positions \((r=0.09-0.41)\).

**DISCUSSION & CONCLUSION**
The lack of correlation in the COP outcome measures and the differences in the stability achieved between sitting and standing positions support the weak relationship between these postures. These results may be explained, in part, by differences in mechanical parameters (e.g.; lower center of mass in sitting position, reduced base of support in standing position, larger moment of inertia of the moving body in standing position) and in postural strategy that balance demands require for sitting and standing position (i.e. mainly ankle strategy in standing and mainly hip strategy in sitting). However, the similarities between standing and unsupported sitting position on ML component suggested close postural strategy on this direction. Since close postural control seems to occur when sitting stability is modified due to upper limbs movement, future studies investigating the relationship between dynamic sitting postural stability and quasi-static and dynamic standing postural stability are warranted.

**REFERENCES**

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