Anticipatory Postural Adjustments in Gait Initiation from Different Initial Stance Width

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INTRODUCTION:
Gait initiation (GI) is a complex motor task that entails the transition from a quiet standing posture to dynamic equilibrium. The preparatory phase of GI involves anticipatory postural adjustment (APA) in which the centre of pressure (COP) shifts backward and toward the swing limb, to move the body centre of mass (COM) forward and over the stance limb. The motor program of GI may change when characteristics of the task changes, such as initial stance condition [1].

The mechanism of generation of forward propulsive force (PF) during GI remains controversial in the literature [2]. According to Do and Michel [3], the generation of the PF results mainly from the oscillation of the swing limb. The motor program of GI may change when characteristics of the task changes, such as initial stance condition. However, whether this finding is influenced by initial stance width remain unclear.

Thus, this study aimed to evaluate the strategies and associated anticipatory postural adjustments (APA) by measuring the centre of pressure (COP) trajectory, anteroposterior (A/P) progression velocity of the centre of mass (COM), and maximal net moment taken by the stance limb during GI with different initial stance width.

MATERIALS AND METHODS:
Ten healthy young adults participated in our study. Being each foot from two separated force plates, subjects initiate their gait with five initial stance conditions (Feet Aside, 50, 100, 150, and 200% of pelvis width (PW)). Kinematic and kinetic data were measured using a Vicon system (U.K.) and two forceplates (AMTI, U.S.A.).

Maximal COP displacement in the mediolateral and anterioposterior directions, A/P velocity of COM at stance toe off, and the maximal net moment about the COP of the stance limb in the frontal plane were calculated and tested with a repeated measures analysis of variance for initial stance width effects (α=0.05) using SPSS 13.0. Those calculated moment were then normalized by BW and LL.

Figure 1 COP displacement in the A/P and M/L directions in three different initial conditions, (a) feet aside, (b) PW, and, (c) 2PW.
RESULTS:
It was found that preparation for GI from wider stance width was associated with a significantly larger COP displacement towards the swing limb (Figure 1). Maximal net frontal plane moments about the stance limb for wider stance width has also tendency of being greater than those for narrow initial stance width (Figure 2). However, A/P COM velocity at the moment of stance toe-off is not influenced by initial stance width (Figure 3).

DISCUSSION:
Backward A/P net moment were absent in feet aside condition and decreased in 2 PW condition as it appeared at the beginning of the cycle in the middle range PW conditions. The change in motor organization will be associated with biomechanical organization in terms of PF. The progressive velocity were increase when gait initiate with wider width, however, when the stance width being two times of PW, the velocity decrease significantly in a mild manner. The progressive velocity can be taken as an index of performance. The instantaneous velocity of COM results on the integration of all the PF acting on the body which is contained in the ground reaction. Its value is an expression of the peripheral effects of external and internal forces. The optimal solution may be related to how the motor program underlying the control of the progressive velocity of the COM is modified during the GI process. Our findings have some clinical relevance, in the difficulty with a predictive mode of control may underlie some of the problems with GI experienced by neurological patient.

REFERENCES