

## Postural Stability When Leaning from Perceived Upright

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The transition between quiet stance and gait requires the volitional movement of one's center of mass (COM) toward a limit of stability (LOS). The goal of this study was to measure the effect of leaning from perceived upright on postural stability when voluntarily maintaining fixed stance positions and during perturbations of the support surface. The COM was derived from force plate data in 12 healthy subjects while standing with feet positioned so that lateral base of support was equal to foot length. For all conditions, arms were folded and subjects were instructed to lean without bending at the hips or lifting their feet. The LOS was determined during maximal voluntary leans with eyes open and closed. The COM was then displayed on a monitor located in front of the subject. Subjects were visually guided to lean toward a target position, maintain this position for 10s, return to upright, and then repeat the same targeted lean maneuver with eyes closed. Targets were randomly presented at 2° in 8 directions and between 2-6° in these same directions according to the asymmetric LOS. Subjects were then verbally guided to lean between 2° back and 4° forward prior to a perturbation of the support surface in either a forward or backward direction. The average LOS was 5.8° forward, 2.9° back, and 4.8° in left/right directions, with no significant difference between eyes open and closed. Center of pressure (COP) velocity increased as subjects maintained fixed stance positions farther from upright, with increased variability during eyes closed conditions. The time to stability and COP path length increased as subjects leaned opposite to the direction of the support surface perturbations. We conclude that postural stability is compromised as subjects lean away from perceived upright, except for perturbations that induce sway in the direction opposite the lean. The asymmetric LOS relative to perceived upright favors postural stability for COM movements in the forward direction.