INTRODUCTION

The ability to effectively respond to perturbations is required to maintain stability and prevent falls during walking. Individuals with lower-limb amputation face higher risk of falling, possibly due to loss of distal sensation and physical limitations such as lack of ankle control. These patients are therefore commonly assumed to be less stable than able-bodied individuals [1-3]. However, recent findings do not fully support the assumption [2,3].

Assessments of stability commonly focus on the mediolateral (ML) direction because walking is more unstable in that direction [4,5]. Dynamic margins of stability (MOS) [6], a measure that incorporates foot placement and center of mass (COM) velocity, has been used to assess responses to controlled perturbations in healthy adults [4]. Along with the direct measurement of COM motion, it can be used to indentify compensatory strategies adopted by individuals with unilateral transtibial amputation (TTA) [2].

This study quantified MOS and COM motion to assess ML dynamic stability in individuals with unilateral transtibial amputation (TTA) and able-bodied (AB) controls as they responded to continuous ML visual or mechanical perturbations.

RESULTS AND DISCUSSION

Mean MOS during PLAT and VIS conditions were greater than NOP for both AB and TTA (p < 0.005; Fig. 1A). PLAT and VIS also exhibited greater MOS variability than NOP for both groups (p < 0.001). For controls, mean MOS were greater on the right side than on the left (p < 0.05). No between-group differences were found for either mean MOS or MOS variability.
Mean BOS-COMIC for VIS and PLAT conditions were greater than NOP for both AB and TTA group (p < 0.001; Fig. 1B). AB exhibited greater mean BOS-COMIC on the right leg than on the left leg (p < 0.05). TTA exhibited greater mean BOS-COMIC on the intact limb than the prosthetic limb (p < 0.005). Finally, during the PLAT condition, TTA exhibited greater values than AB for BOS-COMIC variability (p < 0.005; not shown), mean and variability of ROM (p < 0.01; not shown), and variability of PV (p < 0.05; not shown).

CONCLUSIONS

Patients with unilateral TTA who are active and otherwise healthy were not “less stable” (as determined using mean MOS) than able-bodied controls when mechanically or visually perturbed. However, between-limb differences and between-group differences found in COM motion suggest that amputees used different strategies than controls for adjusting stepping movements to respond to the applied perturbations. These different strategies then allowed them to achieve the same mean performance as AB.

REFERENCES


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