

PHYSICAL ASSISTANCE CAN BE DETRIMENTAL TO LEARNING WALKING BALANCE

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INTRODUCTION

Balance impairments are common in patients with neurologic injury and in the elderly. Designing therapeutic interventions for improving walking balance could greatly improve functional mobility in millions of individuals. Although physical assistance is often provided during rehabilitation therapies to improve balance, it is not clear how assistance affects motor learning of complex skills. The purpose of our study was to determine how physical assistance affects motor learning of walking balance. Physical guidance may be detrimental to learning because it removes opportunities for error detection and correction.

In this study, two groups of subjects were evaluated before and after 30 minutes practice walking on a narrow treadmill mounted balance beam (beam-mill). The first group practiced the task without assistance (Unassisted), while the second group practiced with assistance (Assisted) provided by a lateral assist device (Donelan et al., 2004) (Figure 1). The device used springs to provide a restoring force whenever the pelvis moved away from the beam-mill center. We hypothesized that the group that practiced the task without assistance would improve their ability to walk on the beam more than the group using assistance.

METHODS AND PROCEDURES

Seven subjects walked on a treadmill mounted balance beam for 5-minute pre- and post- practice evaluations. The beam was 2.5 cm wide and 2.5 cm tall. Treadmill speed was

set at 0.22 m/s. Subjects were given instructions to walk heel-to-toe with arms crossed and not to lean forward, twist, angle their feet away from the longitudinal direction of the beam, or look down at their feet. View of the walking surface was obscured by using dribble goggles. All subjects wore standardized shoes. If the subject stepped off the beam, she had to wait five seconds before attempting to walk on it again.



Figure 1. A subject walking on the beam-mill with a lateral assist device used to provide a restoring force towards the center of the beam.

Four subjects were in the Assisted group and three subjects were in the Unassisted group. During practice, the Assisted group walked on the beam-mill with the lateral assist device, and the Unassisted group did not. The practice duration was 30 minutes with rest breaks every 10 minutes.

Subjects were evaluated over a 3-minute period during unassisted walking on the beam-mill before and after training. We assessed beam walking performance by calculating the percentage of time the subject was on the beam (not touching the treadmill surface with either foot) and by calculating

the root-mean-square (RMS) and the standard deviation (SD) of the medio-lateral movement of markers placed at the sacrum and the left shoulder, respectively (Motion Analysis Corporation, Santa Rosa, CA; 120 Hz).

RESULTS AND DISCUSSION

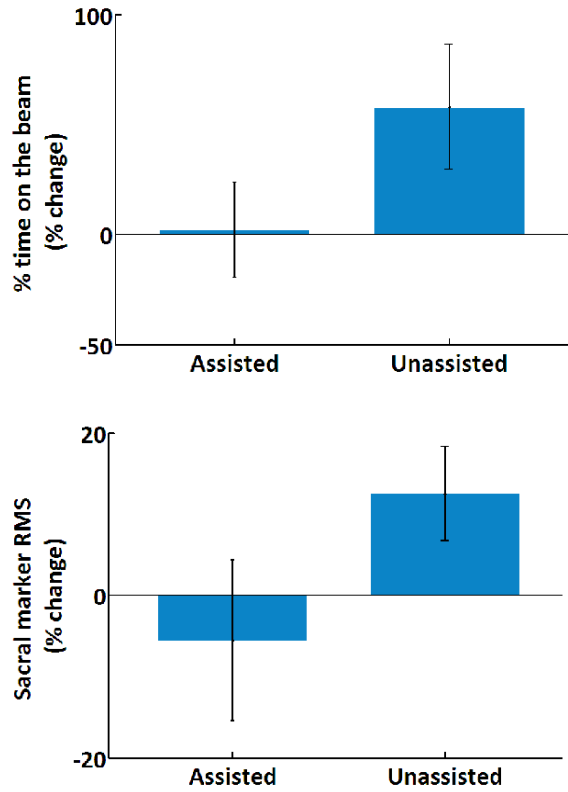


Figure 2. Percent change after training in time on the beam and sacral marker RMS. Vertical lines indicate standard error of the mean.

The Unassisted group made greater improvements in time spent on the beam (~58%) than the Assisted group (~2%) (Figure 2). This suggests that practicing without the assistance was more beneficial for learning beam walking balance because it was task specific and allowed the subjects to explore the dynamics of the task. The Unassisted group spent less than half the practice time on the beam (~44%). When subjects used the assistance, error was

minimized during practice (on the beam ~86% of practice time), decreasing opportunities to learn error detection and correction.

In the Unassisted group, subjects had larger movements in the sacral marker after training. This suggests that either these subjects preferred to use movement at the pelvis to maintain balance or they were more comfortable allowing greater movement at the pelvis because they were aware of their limits of stability.

SUMMARY/CONCLUSIONS

Unassisted practice was more beneficial to learning walking balance than assisted practice in neurologically intact subjects. This was demonstrated by the greater improvements in time walking on the beam-mill for the Unassisted group compared to the Assisted group. Future studies need to separate the effects of assistance and the amount of error experienced during practice as confounding factors affecting learning.

REFERENCES

Donelan, JM et al. (2004). *J Biomech*, 37, 827-835.

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