

## TREADMILL VERSUS OVERGROUND RUN TO WALK AND WALK TO RUN TRANSITION SPEED IN UNSTEADY STATE LOCOMOTION CONDITIONS

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### INTRODUCTION

Recently it has been argued that the transition between walking and running is a gradual process instead of a distinct event [2]. If this is true then transitions should preferably be studied in a protocol with gradually changing speed. Furthermore it has been found that the magnitude of acceleration has an effect on the transition speed. The easiest way to impose such a constant acceleration is by the use of a motor driven treadmill. Although the mechanics of treadmill locomotion and overground running do not fundamentally differ, various kinematical [1], physiological and perceptual differences exist. It might be possible that one or more of these differences affect the run to walk transition (RWT) or the walk to run transition (WRT).

The purpose of this preliminary study was to determine whether treadmill versus overground locomotion differ in transition speed in a protocol with gradually changing speed.

### METHODS

4 female subjects (height:  $170.8 \pm 2.3$  cm) performed several RWT's and WRT's at 3 constant accelerations ( $\pm 0.05$ ,  $\pm 0.07$  and  $\pm 0.10 \text{ms}^{-2}$ ) on a motor driven treadmill and an overground walkway. They were instructed to change from walking to running or vice versa when it felt most natural to them.

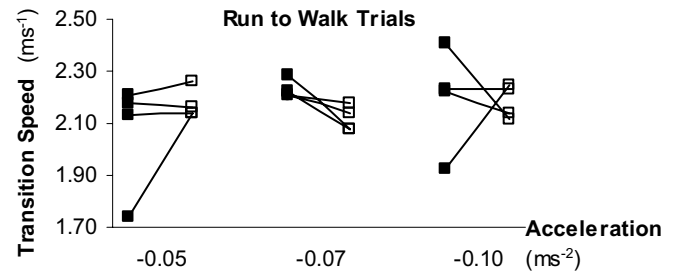
In the treadmill protocol transition speed was defined as the average speed of the treadmill belt during the transition step. The transition step was defined as the first step with a double stance phase in a RWT or the first step with a flight phase in a WRT. In the overground protocol the constant acceleration was imposed by means of a row of flashing lights which the subjects had to "follow" as closely as possible. The transition speed was defined as the average forward speed of a marker at C7 during the transition step. This speed was obtained from motion analysis (Qualisys, 240 Hz).

In each condition 3 trials were retained. Statistical analysis was done in MS Excel 2002 and SPSS (11.0)

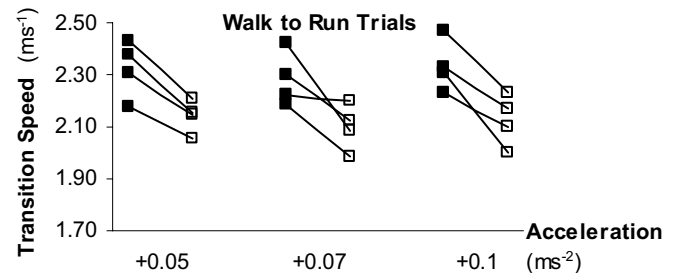
### RESULTS AND DISCUSSION

Visual inspection of the results showed that intra subject variability was acceptable so further analysis could be done with average values of each subject. The average transition speed of each subject is shown in two scatter plots: one for the RWT's (figure 1) and one for the WRT's (figure 2). In figure 1 we see no systematic relation between the average RWT speed in the overground condition and the treadmill condition. From figure 2 however it seems that all subjects started running sooner (i.e. at a lower speed) when they performed a WRT on the treadmill. Non parametric analysis with a Wilcoxon test showed a trend towards significant differences

between the overground condition and the treadmill condition in all three WRT accelerations. ( $p = .068$ ,  $Z = -1.83$ )



**Figure 1:** RWT transition speed of four subjects in the overground condition (filled squares) and the treadmill condition (open squares)



**Figure 2:** WRT transition speed of four subjects in the overground condition (filled squares) and the treadmill condition (open squares)

These results can probably be linked to the fact that many authors found that on a treadmill subjects tend to change their kinematics to "a pattern that provides them with more security" as a means of avoiding falling off the back of the treadmill [1]. It makes sense that the subjects only alter their transition speed in the WRT condition because the WRT is probably more intimidating than the RWT. In the WRT the subjects face the risk of being thrown off the back of the treadmill if they are unable to match the increasing speed whereas in the RWT they probably perceive this as less likely because the treadmill is slowing down.

### CONCLUSION

The results of this preliminary study should be interpreted with caution, because of the small population. Nevertheless a clear difference in WRT transition speed has been found between treadmill and overground locomotion. We believe that it is worthwhile to continue this research on a larger scale so that we will be able to use more stringent statistical methods and be able to determine if the use of a treadmill can be justified in transition studies with a gradually changing speed protocol.

### REFERENCES

1. Alton F, et al. *Clin Biomech* **13**, 434-440, 1998.
2. Li L, et al. *Res Q Exercise Sport* **73**, 229-237, 2002.