

EFFECT OF RECOVERY RESTRICTIONS ON THE THRESHOLD OF BALANCE RECOVERY PRELIMINARY RESULTS

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INTRODUCTION

It is only recently that studies have focused on postural perturbations at the threshold of balance recovery, i.e., postural perturbations large enough that balance recovery is not always possible and a fall can occur. The knowledge at the threshold of balance recovery is thus very limited. In particular, the effect of recovery restrictions on the threshold of balance recovery has not been quantified, despite evidence of its importance during small and medium postural perturbations [1-4]. Therefore, the purpose of this study is to quantify the effect of recovery restrictions on the threshold of balance recovery.

METHODS

Balance recovery following sudden release from an initial forward lean was performed by six healthy younger adults, three males and three females (23.3 ± 2.3 yrs, 1.74 ± 0.07 m, 67.1 ± 11.5 kg). The maximum forward lean angle that these younger adults could be released from and still recover balance was determined using i) only a single step, ii) no more than 2 steps and iii) no recovery restriction. The forward lean angle was sequentially increased until the subjects failed to recover balance twice at a given angle and the types of recovery restrictions were randomly ordered. Forward lean angles, reaction times, weight transfer times, first step times, first step lengths and first step velocities were measured using force platforms (AMTI, Newton, MA) and an Optotrak motion measurement system (NDI, Waterloo, ON). One-way analyses of variance with repeated measures were used to determine the effect of the type of recovery restriction.

RESULTS AND DISCUSSION

The type of recovery restriction did not significantly affect maximum forward lean angles that younger adults could be released from and still recover balance (Figure 1 and Table 1). Moreover, at the maximum forward lean angles, the type of recovery restriction did not significantly affect reaction times, weight transfer times, first step times and first step velocities (Table 1). However, at the maximum forward lean angles, the type of recovery restriction significantly affected first step lengths (Table 1). Specifically, first step lengths using only a single step were significantly longer than those using no more than 2 steps ($p = 0.008$).

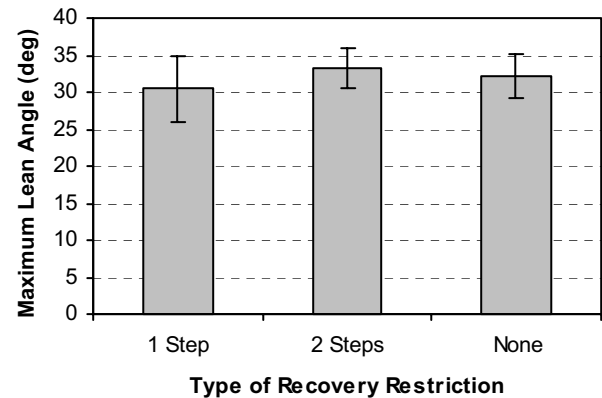


Figure 1: Effect of the type of recovery restriction on the maximum forward lean angle that younger adults could be released from and still recover balance ($p = 0.156$).

CONCLUSIONS

Preliminary results have shown that, despite possibly lengthening the first step, restricting balance recovery to only a single step does not significantly decrease the postural disturbance younger adults could sustain. Therefore, recovery restrictions do not seem to affect the threshold of balance recovery. Further experiments are needed to confirm these preliminary results in a larger sample of younger adults and, more importantly, in a sample of older adults.

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Table 1: Effect of the type of recovery restriction on the threshold of balance recovery.

Type of restriction	1 Step	2 Steps	None	p
Maximum Lean Angle (deg)	30.4 ± 4.5	33.2 ± 2.7	32.2 ± 3.0	0.156
Reaction Time (ms)	82 ± 5	82 ± 11	80 ± 11	0.754
Weight Transfer Time (ms)	138 ± 10	130 ± 17	138 ± 15	0.321
First Step Time (ms)	192 ± 25	164 ± 16	170 ± 27	0.098
First Step Length (m)	1.029 ± 0.082	0.842 ± 0.050	0.872 ± 0.155	0.034
First Step Velocity (m/s)	5.415 ± 0.717	5.184 ± 0.638	5.147 ± 0.636	0.213