

THE EFFECT OF DUAL TASK AND PROPRIOCEPTIVE STIMULATION ON STEPPING ABILITY FOR FALLERS AND NONFALLERS

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INTRODUCTION

Normal aging is usually demonstrated on changes in the sensory, neurological and musculoskeletal systems. These changes might affect balance and gait, even related to elder's falls. Balance control and gait might be affected by another task performed concurrently. However, few studies have investigated the effect of dual task on the stepping ability for the old adults as well as fallers. Whether proprioceptive stimulation could improve the ability to cope with the dual task challenge has not been explored. The purpose of this study was to explore whether dual task would affect the gait initiation ability differently in a group healthy old adults and a group of old adults with fall experiences. Moreover, whether an externally applied proprioceptive stimulation produced by weight would affect the stability of the stepping ability was also investigated.

METHODS AND PROCEDURES

We would like to recruit 30 older adults from the Tainan, Taiwan. A dual task paradigm (motor and cognitive tasks)

was used in the current study. For the motor task, all participants were asked to perform three times of anterior, lateral, and posterior stepping tasks using their normal walking speed. Cognitive task was backward counting by 7. There were four experimental conditions including: single task, dual task, single task with weight, and dual task with weight. ANOVA with repeated measures was used for data analysis. Significant level was set at $p < 0.05$.

RESULTS

In the preliminary results, twenty two older adults (fallers' age: 76.3 ± 5.6 ; non-fallers' age: 74.8 ± 7.9) were recruited, including 11 normal elderly and 11 fallers. Compared with the single task condition, stance ($P < 0.001$), swing time ($P < 0.001$), and its variability ($P < 0.001$) increased significantly for the dual task condition. Besides, step length decreased under the dual task condition ($P = 0.001$). Comparing the difference between fallers and non-fallers, fallers had longer stance time ($P = 0.036$) and shorter step width ($P = 0.038$). Stance time decreased while we added weight on subjects' leg ($P = 0.004$).

Although adding weight to the dominant leg decreased the stance and swing time variability; it did not reach significant level. Compared with baseline data, the speed of cognitive tasks was slower, it almost reached the significant level ($P=0.051$). The accuracy of cognitive task decreased significantly under the dual task condition ($P=0.031$).

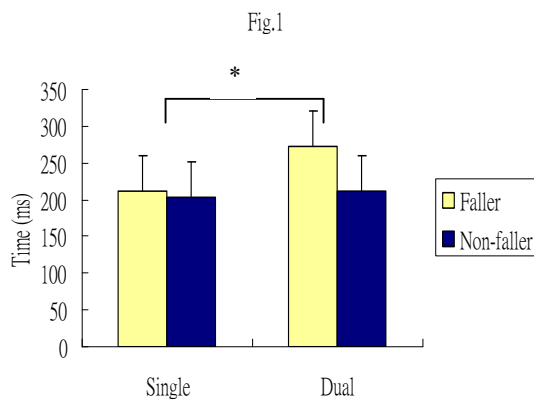


Fig 1. Stance time between two task conditions and two groups.

DISCUSSION

All of the subjects had longer stance, swing time and larger variability under the dual task condition. Due to limited attentional resource, subjects slowed down their stepping speed for the dual task trials. Also, slower stepping speed might cause larger variability for the dual task trials. Our subjects decreased their step length for the dual task condition which might be due to they were afraid of falls and dared not to step out.

Fallers had longer stance time and

shorter step width compared to non-fallers. Fallers used longer stance time to maintain their balance. On the other hand, shorter step width might reduce their base of support, fallers might be easier to experience fall compared to non-fallers. Stance time decreased while we added weight on subject's leg. The adding weight provided a downward force (proprioceptive stimulation), therefore subjects tended to step down their legs sooner. Subjects did not decrease their stance and swing time variability significantly which was probably due to large variance among subjects. Also, the amount of weight might not be sufficient to cause the change of motor control pattern.

SUMMARY

Subjects increased the stance time for the dual task trials, especially for fallers. Fallers tended to use a more conservative pattern such as increase of stance time to cope with the dual task trials. Proprioceptive stimulation might be effective to decrease variability of gait parameters but dose should be re-considered.

REFERENCE

Melzer, I. & Oddsson, L. I. (2004). The effect of a cognitive task on voluntary step execution in healthy elderly and young individuals. *J Am Geriatr Soc*, **52**, 1255-62.