EFFECT OF A DUAL TASK ON WALKING PERFORMANCE IN PRESCHOOL CHILDREN

Rong-Ju Cherng, Ling-Yin Liang and Yang-Ting Young
Department of Physical Therapy, College of Medicine, National Cheng Kung University, Tainan, Taiwan
email: rjc47@mail.ncku.edu.tw

INTRODUCTION

In many situations, children at preschool need to perform motor or cognitive tasks concurrently while walking. For example, they may be talking, carrying a lunch tray, listening to the teacher's instructions, etc. when they walk. Therefore it is important to understand the potential effect of concurrent tasks on walking. The purpose of the study was to examine the influence of a concurrent motor or cognitive task on walking performance in typically developing preschool children.

METHODS

Fifty-five typically developing 4- to 5- year-old (M = 60.1 months, SD = 6.9) preschool children, 28 boys and 27 girls participated in the study. Each child performed 3 trials for each of the following 5 test conditions: free walking (single task), walking while carrying an empty tray (concurrent motor task – easy), walking while carrying a tray with 7 marbles inside the tray (concurrent motor task – hard), walking while performing a forward digit rehearsal task (concurrent cognitive task – easy), walking while performing a backward digit rehearsal task (concurrent cognitive task – hard). The sequence of the conditions was randomly determined for each child. The digit rehearsal task was adjusted individually according to each child's digit span assessed before the experiment. Several measures of walking performance were collected, three of which were reported here: velocity (cm/s), stride length (cm), and cadence (steps/min). Repeated measures one-way ANOVA was used to analyze the differences of walking performance among single task: free walking, and dual motor task, and dual cognitive tasks. Two-way ANOVA (2 task x 2 level) was used to further analyze the dual-task cost interaction between type and difficulty level of secondary tasks. A level of 0.05 was used for statistical significance.

RESULTS AND DISCUSSION

Table 1 presents the walking performance under single and dual task conditions. There were significant difference of walking performance (velocity, stride length and cadence) between free walking and motor dual or cognitive dual tasks. However, there was no significant difference of walking performance between motor dual or cognitive dual condition. Figure 1 presents the dual-task cost of gait velocity between motor and cognitive dual tasks. The results showed a significant level effect ($p<0.001$) and the interaction effect of the type and level of the secondary tasks ($p<0.001$). However, there was no significant difference of the type effect (n.s.)

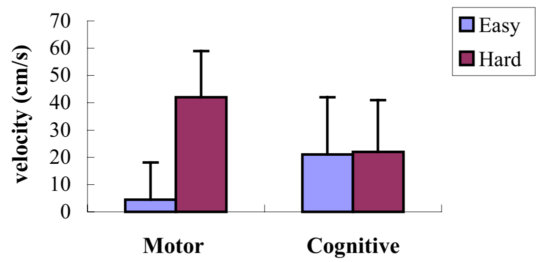

Figure 1: Dual task interference cost of gait velocity

The reaction time of easy and hard cognitive task at single task test condition was significantly different with 1.16 s and 1.43 s respectively ($F=23.929$, $p<0.000$). However, the reaction time of easy or hard cognitive task was not significantly different between at single task and at dual task. (1.16 s vs. 1.23 s; $F=2.666$, $p=0.105$ and 1.43 s vs. 1.69 s; $F=3.121$, $p=0.080$ respectively).

Combining the results of reaction time and the walking performance, we proposed that the reason of no difference of gait velocity between easy and hard cognitive task is that the interference of the cognitive task on gait velocity may be a fixed amount, not affected by its difficult level. Carrying a tray (motor dual task) needs visual monitoring, which may share a common visual motor control of gait. Carrying a tray with marbles in it needs more load of visual motor control than carrying an empty tray. Therefore, the interference effect was bigger with hard level than easy level of the task. Future studies are needed to investigate which phases or events of gait cycle are affected by the dual motor or dual cognitive tasks.

CONCLUSIONS

Children of 4- to 5-year-old have difficulty maintaining walking performance by decreasing their walking efficiency (decreasing speed, stride length and cadence) while concurrently performing other motor or cognitive task.

Table 1: Walking performance under single and dual task conditions

	Single Task Free Walking	Dual Task-Motor Task			Dual Task-Cognitive Task		
		Easy	Hard	Total	Easy	Hard	Total
Velocity (cm/s)	85.86 ± 22.33	82.54 ± 20.30	42.69 ± 17.88	62.62 ± 27.62	64.68 ± 18.79	62.77 ± 19.87	63.73 ±19.28
Stride Length (cm)	81.74 ± 9.30	79.81 ± 6.75	51.38 ± 9.99	65.60 ± 5.93	70.5 ± 8.06	68.44 ± 9.27	69.49 ± 7.87
Cadence (steps/min)	125.62 ± 22.55	125.28 ± 18.95	97.90 ± 21.57	111.59 ± 24.44	110.43 ± 22.73	108.29 ± 23.66	109.36 ± 23.12