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EFFECT OF DUAL-TASK IN THE KINETIC PARAMETERS OF WALKING IN INDIVIDUALS WITH ALZHEIMER'S DISEASE

Orcioli-Silva D, Barbieri FA, Santos PCR, Simieli L, Macari AB, Vitório R, Gobbi LTB

UNESP – Universidade Estadual Paulista– LEPLO – Rio Claro – Brazil
email: diego_orcioli@hotmail.com

SUMMARY

Kinetic analysis of walking may provide information about how the elderly keep walking pattern and balance when performing a dual-task, specially for older adults with Alzheimer’s disease (AD). The aim of this study was to analyze the effect of the dual-task in the kinetic parameters of walking in individuals with AD. Eleven individuals with AD and eleven healthy elderly people participated of the study. The results showed that participants greater impulse braking and propulsive vertical and anterior-posterior. Healthy elderly and elderly with AD are were limited resources for information processing similarly. Both groups increase of braking and propulsive anterior-posterior and vertical impulses, which indicates a loss of walking automatic.

INTRODUCTION

Walking is considered an automatic motor task [1] and has been associated with preservation of cognitive functions in elderly [2]. However, elderly with Alzheimer's disease (AD) show both cognitive and walking impairment [3]. Moreover, elderly with AD have a less automated walking, especially when a concurring executive task (dual-task) is performed during walking, increasing the risk of falls [4,5]. The dual-task demands of individuals divided attention, which may interfere on walking and balance control [6]. Kinetic analysis of walking may provide information about how the elderly keep walking pattern and balance when performing a dual-task [7]. In addition, adjustments in kinetic analyzes on walking with dual-task may indicate possible fallers [8]. Researches have indicated that healthy elderly suffer interference in kinetic parameters when performed a dual-task during walking [9,10]. However, it is little knowledge about the effects of dual-task in kinetic parameters of walking in older adults with AD. The aim of this study was to analyze the effect of the dual-task in the kinetic parameters of walking in individuals with AD and healthy elderly.

METHODS

Eleven individuals with AD and eleven healthy elderly people (control group) participated of the study. The individuals with AD were diagnosed with AD according to the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR) [11]. The patients with DA showed mild disease stage, according to the Clinical Dementia Rating scale – CDR (Table 1). The participants were evaluated by the Mini-Mental State Examination (MEEM), Clock-Drawing Test (CDT), and the Frontal Assessment Battery (FAB) to characterize the groups. For analysis of the walking, the patients walked over an 8m pathway at self-selected velocity. Participants performed 5 trials on the following tasks: walking without dual-task and walking with dual-task. The secondary task performed by patients during walking was countdown from 20 to 1. Trials order was randomized for each patient. The kinetic parameters were collected from one force platform (AMTI - sampling frequency 200Hz), positioned in the center of the walkway. We analyzed the braking and propulsive vertical and anterior-posterior impulses. The kinetic parameters were normalized by weight. Clinical variables and kinetic parameters of walking were statistically analyzed with SPSS 18.0 for Windows®. The clinical variables were compared between the groups by ANOVA one way. The kinetic parameters were analyzed by MANOVA (group x walking) with repeated measures for walking factor (walking with and without dual-task). Bonferroni post hoc test was used to localize the differences.

Table 1. Participants characteristics according group. P-values indicate the comparasion between groups.

	Control	AD	p-values
Age (years)	77.91±5.28	79.82±5.60	0.420
Weight (kg)	60.62±9.11	61.93±10.23	0.755
Height (cm)	151.64±6.18	155.76±7.80	0.184
CDT (pts)	9.09±0.54	6.27±2.05	**0.001**
MEEM (pts)	27.36±2.42	19.27±3.66	**0.001**
FAB (pts)	16.18±1.40	13.45±3.17	**0.017**

CDT: Clock-Drawing Test; MEEM: Mini-Mental State Examination; FAB: Frontal Assessment Battery.

RESULTS AND DISCUSSION

The patients with AD had lower values in all clinical variables than the control group (Table 1). The MANOVA did not show effects of group ($F_{11.10}$ = 2.57, p<0.07) and interaction of group*walking ($F_{11.10}$ = 0.94, p<0.54). The MANOVA indicated only effect of walking ($F_{11.10}$ = 4.613, p<0.011). Independent of the group, the elderly showed greater braking and propulsive vertical ($F_{1.20}$ = 10.023, p<0.005, and $F_{1.20}$ = 13.82, p<0.001, respectively) and anterior-posterior ($F_{1.20}$ = 10.39, p<0.004, and $F_{1.20}$ = 21.29, p <0.001, respectively) impulses (Table 2).

The results showed the interference of dual-task on the kinetic parameters of elderly people. In the anterior-posterior direction, the results indicated that the elderly increases braking impulse, which is an indicative of loss of walking automaticity. High braking impulse is related to a reduction in walking velocity that can improve the processing of the cognitive task [12]. Consequently, due to the increase in braking impulse, the elderly required a greater force of propulsion to perform the next stride. Furthermore, the vertical component confirms these findings, since the elderly increase both acceleration and deceleration phase, indicating a modulation walking velocity. The elderly walk more slowly during walking with dual-task to plan the task and to process the information [12]. Therefore, cognitive processing during walking in the elderly may increase the risk of falls [13].

The modulations in walking occurred during a dual-task may result from an impairment of cognitive processing [9]. Being that aging itself can lead to these deficits. The dual-task requires substantially more information-processing center. The available processing resources are limited, which can lead to interference in tasks in healthy elderly [10], especially in patients with AD [12].

CONCLUSIONS

Healthy elderly and elderly with AD are were limited resources for information processing similarly. Both groups increase of braking and propulsive anterior-posterior and vertical impulses, which indicates a loss of walking automatic.

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Table 2. The means and standard deviations of kinetic parameters without and with dual-task for older adults with AD and control group..

		Without dual-task	With dual-task	p
Impulse Braking vertical	Control	0.25±0.04	0.34±0.16	**0.005**
	AD	0.29±0.04	0.35±0.10	
Impulse Propulsion vertical	Control	0.27±0.05	0.36±0.15	**0.001**
	AD	0.33±0.04	0.39±0.07	
Impulse Braking anterior-posterior	Control	-0.02±0.01	-0.03±0.01	**0.004**
	AD	-0.02±0.01	-0.03±0.01	
Impulse Propulsion anterior-posterior	Control	0.02±0.01	0.03±0.01	**0.001**
	AD	0.02±0.01	0.03±0.01	