

# Validation of stroop color word test as a cognitive task for evaluating cognitive motor interference during walking in Multiple sclerosis.



Giancarlo Coghe, Giuseppina Pilloni, Micaela Porta, Erica zucca, Giuseppe Fenu, Lorena Loreface, Jessica Frau, Maria Giovanna Marrosu, Massimiliano Pau, Eleonora Cocco.

## Background

Many studies dealing about DT of walking in MS do not consider a control group or consider only one gait parameter, moreover many cognitive task has been used. Hence the DT scenario in MS, although very promising, is disorganised and poorly standardized.

## Aim

We aimed to:

- Find a standardized instrument to evaluate CMI by a cognitive task suitable for the mechanisms of DT and MS cognitive profile. ;
- Evaluate different parameters of gait in order to assess the most relevant in CMI;
- Validate the cognitive and gait parameters in MS with an age matched control group.

## Methods

A group of patient with MS and a matched CG were enrolled. The subjects underwent to a 3D gait analysis with dual task. The cognitive task selected was the stroop color word test (SCWT) as it is targeted to both executive functions (mainly related to ambulation) and processing speed (mainly related to MS cognitive impairment). CMI was calculated by means of dual task cost (DTC) of each spatial temporal parameter.

A two-way ANOVA for repeated measures was performed to assess the effect of status (affected by MS or HC) and condition (ST or DT) on the previously listed gait parameters. A one-way MANOVA was carried out to verify the possible effect of status (MS, HC) on DTC, calculated for each spatiotemporal parameter of gait.

Variable	HC group		MS group	
	ST	DT	ST	DT
Stride length (m)	1.35 (0.13)	1.30 (0.14) *	1.11 (0.21) †	1.04 (0.21) † *
Step width (m)	0.19 (0.03)	0.20 (0.04)	0.20 (0.04)	0.21 (0.04) *
Speed (m/s)	1.30 (0.19)	1.23 (0.22) *	0.99 (0.30) †	0.88 (0.29) † *
Cadence (steps/min)	114.07 (8.70)	104.65 (17.31)	112.97 (9.97) †	97.63 (21.43) † *
Stride time (s)	1.06 (0.08)	1.07 (0.10)	1.20 (0.31) †	1.30 (0.44) † *
Stance phase (% gait cycle)	58.98 (1.50)	58.43 (2.76)	61.46 (4.02) †	62.87 (4.42) † *
Swing phase (% gait cycle)	41.10 (1.47)	39.99 (2.19) *	38.34 (3.80) †	36.63 (4.23) † *
Double support (% gait cycle)	18.19 (2.92)	19.92 (4.37)*	24.22 (7.80) †	29.36 (9.67) † *

ST: Single Task condition, DT: Dual Task condition , \* denotes a significant change with respect to ST, † denotes a significant difference vs. HC

DTC (%)	Group		p
	HC	MS	
Stride time	-1.15 (4.39)	- 7.14 (11.13) †	0.005
Stance phase	1.25 (3.98)	-2.36 (4.26) †	0.001
Swing phase	2.61 (3.98)	5.24 (6.33) †	0.030
Speed	4.87 (10.17)	11.71 (12.49) †	0.013
Cadence	0.93 (4.18)	6.32 (9.70) †	0.004

All values are expressed as mean (SD). MS: multiple sclerosis subjects; HC: healthy controls, † denotes a significant difference vs. HC

## Conclusion

The present work provides a validated basis for future studies about CMI in MS. In addition, we found that the CMI, measured by DTC, is present in PwMS and HC, but the motor cost in PwMS is higher. We also highlighted that stride time, stance phase, swing phase, cadence and step width – not only speed – may be evaluated when studying the DT