Efficacy of a Computer-assisted Cognitive Rehabilitation Protocol on Walking in Parkinson's Disease patients with Freezing of Gait: a Pilot Study

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INTRODUCTION

Gait deficits are common and debilitating signs of Parkinson's disease (PD) with consequent disability, falls and reduced quality of life. In the more advanced stages, festination and freezing of gait (FOG) can emerge. Several studies showed a relationship between impaired cognitive functions and gait disorders. The cognitive decline seen in PD patients might exacerbate the difficulties these patients already have in maintaining gait steadiness and rhythmicity. It might lead to FOG and increased risk of falling. Despite the growing interest on gait and cognition, to date there are no studies demonstrating the effect of a cognitive rehabilitation protocol on gait disorders in PD patients.

AIMS

Here, we hypothesized that a computer-assisted cognitive rehabilitation protocol may improve walking performances in people with PD and FOG.

PATIENTS AND METHODS

Study Population

PD subjects were enrolled from patients attending the Movement Disorders Clinic in Catania. According to the inclusion criteria, our patients had a Mini Mental State Examination (MMSE) score > 2622, Hoehn and Yahr stage ≤ 323, disease duration ≥ 5 years, presence of FOG evaluated clinically the day of the assessment as well as historically by The Freezing of Gait Questionnaire. The motor impairment was evaluated using the motor section of the Unified Parkinson's Disease Rating Scale (UPDRS-ME). All patients completed an extensive battery of neuropsychological tests. The motor evaluation was recorded at baseline (T0), after 6 weeks (T1) and at three months (T2) as follow up. All PD patients were measured in ON-state.

Study Protocol

Patients were treated twice a week for six weeks with 1-h sessions of computer-assisted training of attention ability and information processing tasks. Cognitive training was performed using the package RehaCom (http://www.Schuhfried.at) (Fig 1). The rehabilitation training consisted of following modules: attention and concentration; vigilance; visual-motor coordination; logical reasoning; divided attention. All the training sessions were performed in ON state. Gait parameters were recorded by a gait analysis at baseline, after six weeks and at three months.

CONCLUSIONS

Our study presents some limitations as the small sample size, the lack of a control group and the brief rehabilitation protocol. Despite these limitations, as pilot study, it shows that a rehabilitation protocol based on potentiation of executive functions could represent a possible tool to improve walking in PD. To have more effective and prolonged results it should be part of a multidisciplinary rehabilitation program. Further studies are needed to confirm and improve our results.

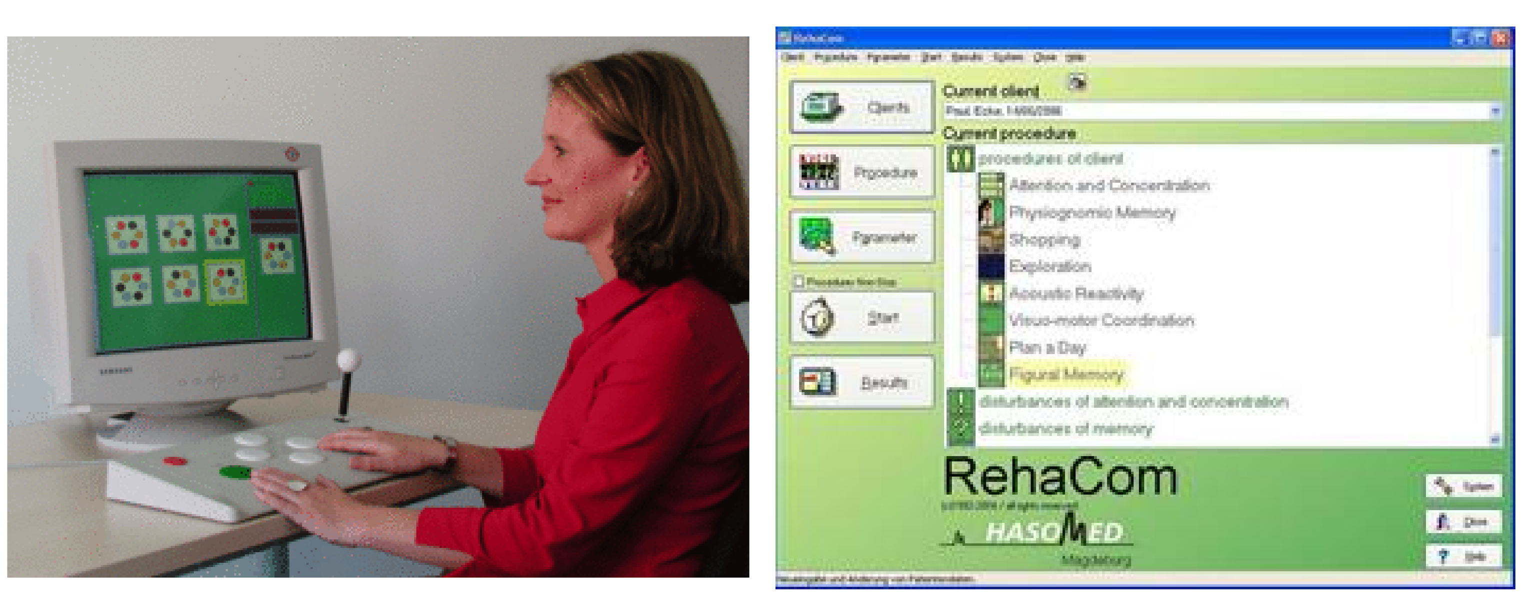
RESULTS

Seven patients completed the assessments at T1, six patients completed the assessments at T2. Clinical-demographical characteristics of included patients at T0 and T1 (N = 7) were: women 3 (42.9%); age 63.6 ± 8.4 years; disease duration 9.1 ± 4.7 years; Hoehn-Yahr stage 2.1 ± 0.2; MMSE score 27.5 ± 0.9; FOG-Q score 12.4 ± 5.5; UPDRS-ME score 25 ± 6.1; AIMS score 5.6 ± 4.9. At T1 with respect to T0 no significant changes were detected in UPDRS-ME (24.1 ± 6.5; p = 0.1) and AIMS (6.6 ± 3.4; p = 0.2) scores. Concerning cognitive assessment, no severe impairments in neuropsychological examination were observed among the study patients. All gait parameters are shown in table 1. Gait cycle duration was significantly improved such as mean velocity and cadence. Although not significantly, other parameters improved compared to the baseline, such as the right and left cycle length, the right and left step length and mean velocity (% height/sec). At the follow up, after three months (T2), all gait parameters returned to the baseline values.

Table 1

	N = 7		
	T0	T1	p value [a]
Right cycle duration (s)	1.14 ± 0.11	1.08 ± 0.07	0.04 *
Left cycle duration (s)	1.15 ± 0.11	1.09 ± 0.08	0.03 *
Right support (s)	0.73 ± 0.09	0.70 ± 0.05	0.09
Left support (s)	0.75 ± 0.08	0.70 ± 0.06	0.02 *
Right swing (s)	0.40 ± 0.04	0.39 ± 0.03	0.08
Left swing (s)	0.41 ± 0.04	0.40 ± 0.03	0.41
Right support phase (%)	64.83 ± 2.61	65.01 ± 1.88	0.79
Left support phase (%)	64.52 ± 2.32	63.93 ± 2.07	0.66
Right swing phase (%)	35.57 ± 2.47	36.11 ± 2.30	0.12
Left swing phase (%)	35.35 ± 1.93	35.99 ± 1.38	0.54
Right double support phase (%)	14.05 ± 1.78	13.76 ± 1.99	0.64
Left double support phase (%)	14.50 ± 2.05	13.90 ± 1.24	0.44
Mean speed (m/s)	0.43 ± 0.05	0.50 ± 0.06	0.01 *
Mean speed (% height/s)	26.17 ± 3.09	29.29 ± 3.96	0.05 *
Cadence (steps/min)	106.02 ± 9.62	111.01 ± 7.13	0.03 *
Right cycle lenght(m)	0.82 ± 0.12	0.86 ± 0.15	0.16
Left cycle lenght(m)	0.83 ± 0.13	0.88 ± 0.13	0.07
Right cycle lenght (%height)	48.35 ± 7.30	50.73 ± 8.79	0.17
Left cycle lenght (%height)	48.71 ± 7.97	51.76 ± 8.11	0.08
Right step lenght (m)	0.39 ± 0.06	0.40 ± 0.06	0.52
Left step lenght (m)	0.37 ± 0.06	0.40 ± 0.08	0.11
Step width (m)	0.18 ± 0.03	0.18 ± 0.03	0.65

Fig 1



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