ISSN: 2165-7025

Novel Physiotherapies

Research Article Open Access

Improvement in Gait Performance after Training Based on Declarative Memory Cues in Patients with Parkinson's Disease: A Randomized Clinical Trial

Maria Elisa Pimentel Piemonte[1]*, Erika Okamoto[1], Carina Assis Ruggiero Cardoso[2], Tatiana de Paula Oliveira, MS[1], Camila Souza Miranda[1], Marina Rigolin Pikel[3], Felipe Augusto dos Santos Mendes[4] and Gilberto Fernando Xavier[5]

[1]*Department of Physiotherapy, Communication Science & Disorders, Occupational Therapy, School of Medicine, University of São Paulo, Brazil*
[2]*Brazil Parkinson Association, Brazil*
[3]*Department of Neuroscience and Behavior, Institute of Psychology, University of São Paulo, Brazil*
[4]*Department of Physiotherapy, University of Brasilia, Brazil*
[5]*Department of Physiology, Institute of Biosciences, University of São Paulo, Brazil*

Keywords: Physiotherapy; Automatic motor control; Cognition

Introduction

Among the motor alterations in PD patients, gait is particularly

DMCS while the control group fulfilled the gait training without the support of any kind of cues or cognitive strategies. To verify retention after the training, participants were assessed and re-assessed as a follow up 2 and 60 days after the end of their training.

Both trainings consisted of 8 individual training sessions, twice a week, for four weeks. After the training sessions, no instruction was offered to patients for training at home.

Experimental training

The ET consisted of 3 phases, the first one (Phase 1) was done only in the first session of training, and the other two (Phase 2 and 3) were repeated at each of the 8 sessions.

Phase 1: Initially, in order to better understand the strategy, patients received a short and simple explanation about the deficiency in automatic movement resulting from PD. Following the explanation, the patients memorized a sequence of declarative cues (Figure 2).

The patients would then move on to the next stage only after having successfully memorized the cue sequence.

Phase 2: Patients organized a sequence of cues using cards illustrating the subcomponent movements (key movement) involved in taking steps. The sole purpose of this approach was to further consolidate the memorization of cues. The patients would then move on to stage 3 only upon completion of 5 consecutive successful attempts.

Phase 3: Gait motor training guided by the cues. In this stage, the patients had to train using declarative cues as a gait performance support through 8 sets following the instruction “Walk in your ordinary speed. Use the key movements to guide your steps saying each of them while you do them”. Each set was performed following different four trajectories with 80 meters of extension. Markers on the ground delimited the straight and crooked trajectories. The declarative cues had to be evoked verbally by the patients themselves, during gait, triggering the corresponding movement. Whenever patients proved unable to use the cues properly, e.g. they were not able to coordinate the retrieval of cues together with the respective movement, they returned to phase 2.

Control training

Phase 1: Patients received a short and simple explanation about the de ciency in automatic movement resulting from PD.

Phase 2: Patients received a general verbal attentional instruction of "pay attention to your steps and try to walk as well as you can", before starting the walk.

Phase 3: Motor training of gait, where the patient had to perform 8 sets, following the instruction "Walk in your ordinary speed, paying attention to your steps" in the identical four trajectories of ET. Additional instructions or cues were not provided by the physiotherapist.

Outcome measures and test procedure

e three assessments were performed in individual sessions by an independent blinded examiner, before (A1) and two (A2) and sixty days (A3) a er the end of training.

All patients were tested at between 40 and 120 minutes a er their last L-dopa dose, whereby each patient was tested at same time of the day.

Primary outcome: e primary outcome was the gait performance in terms of speed and stride length. Patients were asked to walk in a straight trajectory of 20 meters following the sole instruction "upon the go signal, walk as fast as possible to the line and stop". e speed was calculated based on the time to walk 20 meters timed using a digital chronometer. e stride length was calculated based on the number of steps measured using a pedometer.

Secondary outcome: e secondary outcome was independence in activities of ADL, assessed by Section II of the Uni ed Parkinson Disease Rating Scale (UPDRS-II). is section includes 12 questions (items 5 to 16) on patient's performance in ADL. Among these questions, two of them investigate gait performance [frequency of falls due to freezing (14); inability to walk (15)], with scores ranging from zero (normal) to 4. e application followed the procedure recommended by Goetz et al. [44]: (1) Reading to the patient the introductory statement for each item of the UPDRS-II. (2) A er the introduction, the interviewer asked the patient: "With all these considerations in mind, do you have any problems in this activity?" (3) If the initial answer was "No" (likely rating is "Code 0"), the rater probed for "Code 1" to verify that this response is not more appropriate. (4) If the initial answer was "Yes," the interviewer probed for the moderate option, using "Code 2" as an anchor. (5) Depending on subsequent answers to this probed regarding "Code 2," the interviewer should move up or down the scale (to more or less severe options) to nd the most appropriate item response. (6) When the best item response code was determined, the interviewer veri ed this by reviewing those response codes immediately above and the patient should con rm that these other response codes were not appropriate [48].

e UPDRS has been considered by the Movement Disorders

Results

Demographic and clinical characteristics of patients in the two groups at baseline are presented in Table 1. Forty four patients presenting mean disease duration of 6.5 years (SD 2.28), mean age of 70.38 years (SD 5.34), comprising 18 women and 26 men, 24 had stage 2, and 20 stage 3, disease evolution according to the Hoehn and Yahr classi cation. ere were no signi cant di erences between the two groups (unpaired t-test; p > 0.05). All participants completed the training without any adverse e ects.

For gait speed (Figure 3), signi cant e ects were observed for training type [F(1,58)= 40.23, p<.01, ES=.90], and assessments [F(2,116)= 142.31, p<.01, ES=.90] and their interaction [F(2,116)= 113.29, p<.001, ES=.95]. e interaction demonstrated that gait speed increased for ET, but not for CT. Post-hoc intra-group comparisons using the Tukey HSD test showed signi cant improvement between A1xA2, and A1xA3 for ET, but not for CT. Inter-group comparison showed non-signi cant di erences in gait speed in A1, but signi cant di erences in A2 and A3 between EG and CG.

For step length (Figure 4), signi cant e ects were observed for training type [F(1,58)=47.66, p<.01, ES=.90], and assessments [F(2,116)= 181.10, p<.001, ES=.95] and their interaction [F(2,116)=177.24, p<.001, ES=.99]. e interaction demonstrated that step length increased for ET, but not for CT. Post-hoc intra-group comparisons using the Tukey HSD test showed signi cant improvement between A1 X A2, and A1xA3 for ET, but not for CT. Inter-group comparison showed non-signi cant di erences in step length in A1, but signi cant di erences in A2, and A3 between EG and CG.

For independence in ADL (Figure 5), signi cant e ects were observed for assessments [F (2,116) = 358.35, p<.01, ES=.80] and their interaction with training type [F (2,116) =118.35, p<.01, ES=.85]. e interaction demonstrated that punctuation decrease for ET, but not for CT. Post-hoc intra-group comparisons using the Tukey HSD test showed signi cant improvement between A1 X A2, and A1 X A2 for ET, but not for CT.

Figure 3:

ere was a signi cant correlation between the improvements in the gait parameters and independence in ADL in A2 (SLPI X ADLPI, R=.46; GSPI X ADLPI, R=.70) and A3 (SLPI X ADLPI, R=.49; GSPI X ADLPI, R=.75), indicated that the e ects of DMCS were generalized to gait-related ADLs.

To summarize, there was a signi cant improvement in gait speed, step length and independence in ADL a er ET, which remained 60 days a er training.

Discussion

e present study aimed at investigating the e ects of the gait training based on declarative memory cue strategy on gait performance in patients with PD.

Two key findings emerged from this study. The first of these was that DMCS was effective for improving gait speed and stride length in patients with PD and, the most important, the training effects remained after 60 days without any additional training. Few studies have shown long-term results after cue training. Some studies reported retention of the gait improvements after 4 weeks without training [4,10]. The most complete studies that investigated the largest number of patients showed that the effects of the intervention on the gait in absence of cues reduced significantly after 3 and 6 weeks without training [17,18]. Several factors may have contributed to maintenance of the gait improvement in the current study: (1) the support of the declarative system, (2) easy management of cues and, (3) the detailed explanation on the deficiency in automatic control provided to the patients before the training in order to emphasize the need of implementation of the new strategy to minimize the gait disturbance resulting from PD. In comparison with previous studies, these factors may have facilitated the continuous use of the declarative memory cues by patients after the training, increasing the retention of the training effects [51-53].

The second key finding was that the positive effect was transferable to gait-related ADL, considering the improvements in the independence in ADL. These results suggest that, after training, DMCS can be used by patients at home. The tool used to assess the effect on ADL (section II of the UPDRS) has been widely validated and assesses the perception of the patients themselves regarding their performance in ADLs, over the preceding two weeks [49]. The analysis of the longitudinal metric attributes of the UPDRS showed that the independence in ADL is a valid measure for follow-up of PD patients, being more precise than other scales [54]. Additionally, the minimal clinically important change in reference to the status before treatment for the UPDRS-ADL score is two points for Hoehn and Yahr stages 1-2 and three points for Hoehn and Yahr stage 2-3 [55]. Therefore, the mean change found in the current study of 3 points (17.93 ± 4.44 to 14.83 ± 4.13), can be considered clinically important. This represents a further considerable contribution to gait treatment in the light of a systematic review on effects of external cues on gait, which concluded that, despite reliable results in laboratory tests, the evidence of generalization of improvement to gait-related ADLs are limited [56].

Taken together, these findings indicate that the DMCS constitutes an important alternative to treatment of gait dysfunction in PD. One of the mechanisms that might be involved in this strategy could be the attention to movement. Undoubtedly, the increase in attention on gait is an important mechanism activated in this strategy, given the need to retrieve the cues from declarative memory and to manage them during gait. This process most likely depends on working memory and it is well known that this memory module is closely associated with attention. Some studies have indicated that working memory is hampered in PD [57,58] but, even considering that patients in the current study might have had undetected working memory deficits, this would not impair their ability to use the declarative cues. Moreover, it is important to point out that the CT in this study also involved increased attention on gait, and yet positive effects have not been found. Thus, there are two possible alternative explanations behind the differences observed between results obtained from the two strategies: the DMCS allows best engagement of attention, or attention is not the most important factor in improving gait. Further studies are necessary to elucidate possible differences in the demand of attention between the strategies, since this goes beyond the scope of this study. Considering the second possibility, we believe that declarative cues were a key factor impacting the results. After memorization and training, the cues not only engage the patient's attention to their foot movements, but also facilitate the movement chunking involved in the gait, triggering the next movement into a previously memorized sequence. It may compensate the deficiency in automatic control on gait associated to the lack in the movement chunking [40,41]. This evidence sustains the possibility of compensation from declarative memory for implicit deficiency,

Citation: Piemonte MEP, Okamoto E, Cardoso CAR, Tatiana de Paula Oliveira, MS, Miranda CS, et al. (2015) A Comparison between Task Oriented and Client-Centred Task-Oriented Approaches to Improve Upper Limb Functioning in People with Sub-Acute Stroke. J Nov Physiother 5: 277. doi:10.4172/2165-7025.1000277

normalise the temporal and spatial gait variables in Parkinson's disease. J Neurol Neurosurg Psychiatry 65: 580-582.

9. Canning CG (2005) The effect of directing attention during walking under dual-task conditions in Parkinson's disease. Parkinsonism Relat Disord 11: 95-99.

10. Lehman DA, Toole T, Lofald D, Hirsch MA (2005) Training with verbal instructional cues results in near-term improvement of gait in people with Parkinson disease. J Neurol Phys Ther 29: 2-8.

11. Farley BG, Koshland GF (2005) Training BIG to move faster: the application of the speed-amplitude relation as a rehabilitation strategy for people with Parkinson's disease. Exp Brain Res 167: 462-467.

12. ɣ } ɣ ʈ ʞ c4C o DD o | D ¡ǂ P " T ʅ ẘ Þ ‗ ` r ´ 3 ʊ ʅ E ∃ Ố ḑ 3 3 D o D3m ᵟ ꭗ 3 m ᵟ

the importance of augmented information feedback. Exp Brain Res 113: 497-508.

52. Rochester L, Baker K, Hetherington V, Jones D, Willems AM, et al. (2010) Evidence for motor learning in Parkinson's disease: acquisition, automaticity

- L# õ` XLVL :LO $ GLVHDVH