

The Effect of Dynamic and Constant Fast-Precise Movement Learning on the Psycho-Emotional State, Motor and Cognitive Functions of Patients With Parkinson's Disease

Goda Daugė, Dalia Mickevičienė, Rima Solianik, Marius Brazaitis

Lithuanian Sports University, Kaunas, Lithuania

Purpose: This study aimed to compare the effects of dynamic and constant learning of fast and precise arm movements on cognitive, motor, and psycho-emotional functions in patients with Parkinson's disease. Dynamic learning, characterised by constantly changing conditions and the need for adaptation, is considered an advanced motor learning strategy, though its effectiveness in Parkinson's disease remains debated. We hypothesised that dynamic learning would enhance cognitive functions without negatively affecting motor performance or emotional state.

Methods: Thirty-six Parkinson's disease patients (Hoehn and Yahr stages 1–3, aged 55–85) were randomly assigned to control (CG, $n = 10$), dynamic learning (DL, $n = 11$), or constant learning (CL, $n = 15$) groups. The study included: (1) baseline assessment, (2) ten motor learning sessions (DL and CL only), and (3) post-intervention assessment. DL trained with variable targets, CL with a fixed one. Each session involved three sets of 20 dominant-arm movements. Motor, cognitive, and psycho-emotional functions were assessed pre/post intervention. Motor control with a fixed target and movement parameters – reaction time, time to target, average/max speed, and trajectory length – were recorded via DPA-1. Cognitive function was tested using ANAM-4; mood via Brunel Mood Scale (BRUMS). Data analysis included Shapiro–Wilk for normality, paired samples t -test for within-group changes, and one-way ANOVA with post hoc tests ($p < 0.05$).

Results: Only the DL group showed significant cognitive improvements, with reduced reaction times (RT) in multiple tasks (Simple RT, Go/No-Go, Two-Choice RT, Matching Grids, Memory Search) ($p < 0.05$). Motor performance improved only in the CL group, including faster RT and higher movement speed ($p < 0.05$). In the DL group, longer path length in the complex task suggested reduced movement efficiency ($p < 0.001$). No changes were observed in the CG. In the CL group, vigour increased and anger decreased ($p < 0.05$).

Conclusion: Dynamic learning may support cognitive improvement, however, these benefits do not appear to transfer to motor performance, particularly under constant conditions. In contrast, constant learning more effectively enhances motor function and improves emotional state. These findings highlight the importance of tailoring motor learning strategies in Parkinson's disease by considering individual cognitive, motor, and emotional profiles.

