

## SUMMARY

**Background:** One of the most common clinical manifestations of multiple sclerosis is foot drop syndrome, which significantly affects the gait and balance of people with multiple sclerosis (MS). Functional electrical stimulation (FES), which does not normally work with the postural system, appears to be a promising solution. At the same time, it has so far only been found to have an orthotic effect and its effect on balance, mobility, cognitive function and cognitive and motor fatigue has not yet been evaluated.

**Aims:** The aim of the study is to compare the immediate, persistent and overall effect of two physiotherapy interventions using the principles of neuroproprioceptive "facilitation, inhibition" - Motor Programs Activating Therapy (MPAT) and Functional Electrical Stimulation in Postural Corrected Position (FES in PKP) on the clinical manifestations accompanying MS disease and their impact on the quality of life of people with MS.

**Methods:** This is a prospective randomized comparative experimental study in which people with MS with foot drop (N = 44) were divided into two groups and underwent a two-month physiotherapy program. One group was loaned an FES neurostimulator, and the other group received individual outpatient physiotherapy (1 hour, twice a week). Clinical examination was performed one month before, just before, just after and one month after the end of the therapy program. The primary outcomes were **balance**, as assessed by instruments: Berg Balance Scale (BBS), The Time Up and Go Test (TUG), The Time Up and Go Test cognitive (TUGcogn), Dynamic Gait Index (DGI), Activities-specific Balance Confidence Scale (ABC); **gait parameters** assessed by the instruments: Two Minute Walk Test (2MWT), Timed 25-Foot Walk (T25FW), 12-Item Multiple Sclerosis Walking Scale-12 (MSWS-12). **Mobility** was chosen as a secondary outcome and was evaluated by the instruments: Five Times Sit to Stand (5STS), Modified Five Times Sit to Stand (Mod5STS), Four Square Step Test (FSST), Rivermead Mobility Index (RMI), Performance Scale (PS mob), Trunk Impairment Scale-modified Norwegian version (TISmod); **Cognitive function and physical and cognitive fatigue** assessed by instruments: Symbol Digit Modalities Test (SDMT), The Fatigue Scale for Motor and Cognitive Functions (FSMC); **patient-reported outcome measures assessed** assessed by the instruments: European Quality of Life 5 Dimensions (EQ-5D-5L) a Multiple Sclerosis Impact Scale-29 (MSIS-29). For the FES in PKP group, both measurements were performed without the use of the device, and the therapeutic effect was evaluated.

**Results:** Statistically significant improvement of the whole cohort in BBS ( $p < 0.001$ ), MSWS-12 ( $p = 0.009$ ), EQ-5D-5L in dimensions: EQ-5D-5L UA ( $p = 0.012$ ), EQ-5D-5L MO

( $p < 0.001$ ), ( $p_{\text{adjust}} = 0,010$ ), EQ-5D-5L SC ( $p = 0.006$ ), EQ index ( $p = 0.030$ ), EQ VAS ( $p = 0.026$ ) a MSIS ( $p = 0.048$ ). FES in PKP had an immediate therapeutic effect on BBS ( $p = 0.008$ ), mod5STS ( $p = 0.046$ ), ABC ( $p = 0.04$ ) and EQ-5D-5L MO ( $p = 0.005$ ). The positive therapeutic effect on BBS, MSWS-12 and EQ 5D 5L MO was comparable to MPAT. MPAT showed a statistically significant improvement in TISmod ( $p = 0.048$ ), EQ-5D-5L PD ( $p = 0.008$ ), EQ-5D-5L UA ( $p = 0.008$ ), EQ-5D-5L SC ( $p = 0.019$ ), EQ-Index ( $p = 0.06$ ) and MSIS-29 ( $p = 0.043$ ). Except the MSWS-12 test, the effect of the therapeutic interventions persisted one month after the end of the programmes (persistent effect). An overall effect on BBS was observed in the whole cohort BBS ( $p = 0.011$ ), TUGcogn ( $p = 0.047$ ), EQ-5D-5L MO ( $p = 0.009$ ), EQ-5D-5L UA ( $p = 0.003$ ), EQ-5D-5L SC ( $p = 0.004$ ). These improvements were more significant for the FES group in PKP.

**Conclusions:** This study has provided new insights and knowledge on the use of FES in people with MS and has shown that it is possible to influence the clinical manifestations of MS through physiotherapy and thus improve the quality of life of people with MS.