# Evaluating the Effectiveness of Exoskeleton-Assisted Rehabilitation on Gait in Individuals with Parkinson's Disease

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## Summary

Gait and postural impairments in Parkinson's disease (PD) affect disability and quality of life. Functional Kinesiotherapy (FKT) is a standard treatment, while wearable exoskeletons (Ekso) have shown promising results in improving gait. In this study, 40 participants were randomly assigned to FKT (n=20) or Ekso (n=20) groups, and their gait compared with the one of a healthy control group (n=10). Due to COVID-19, seven Ekso participants withdrew. Gait analysis showed differences in after therapy results between pathological groups, and also within groups with respect to UPDRS III scale. Future studies should include larger samples, longer treatment periods, and longer follow-up assessments to evaluate lasting functional gains.

## Introduction

Gait and postural impairments significantly impact disability and quality of life in Parkinson's disease (PD) [1]. Functional Kinesiotherapy (FKT) is commonly used to improve mobility and reduce dysfunction. Recently, wearable exoskeletons (Ekso) have gained attention for restoring functional gait through repetitive training [2,3]. While exoskeleton therapy has shown benefits in post-stroke rehabilitation, its effectiveness in PD has not been investigated yet. This study aimed to assess whether Ekso therapy offers greater gait improvements than FKT in PD individuals.

## Methods

Forty participants were randomly assigned to the FKT group (n=20) or Ekso group (n=20), with a healthy control group (n=10) as a reference. This trial is registered in ClinicalTrials.gov (Identifier NCT04778852). Due to COVID-19 complications, seven Ekso participants withdrew. Ground reaction force (GRF) data were available for only 12 participants per group as PD individuals are characterised by reduced stride length which prevents them from performing a clear foot strike on the force plate. PD specific clinical scales were administered (i.e. UPDRS). Gait analysis was performed at baseline (T0) and post-intervention (T1) using an 8-camera optoelectronic system (120 Hz), synchronized with force plates (960 Hz) and an 8-channel electromyographic system (2000 Hz). Joint kinematics, ground reaction forces, and electromyographic activity of four muscles (Biceps Femoris, Rectus Femoris, Gastrocnemius Lateralis, Tibialis Anterior) were assessed as in [4]. Statistical analyses included parametric and non-parametric tests (p<0.05) and Statistical Parametric Mapping (SPM1d) [5].

## Results and Discussion

Results showed a statistically significant improvement of UPDRS in both groups together with an improvement of all the space time parameters extracted. Concerning GRFs, FKT showed larger improvements in Medio Lateral (ML) components while Ekso showed larger improvements in the Vertical (V) ones. In Figure 1 Ekso results between T0 and T1 are reported.

**Figure 1**: on the left Velocity and % Stance phase are reported (p<0.05 =***); on the right Vertical GFR (on the x axis blue and red line represents SPM results). Blue asterisks = Ekso T0 vs CS; Red asteriskS = Ekso T1 vs CS; Purple asterisks = T0 vs TI.
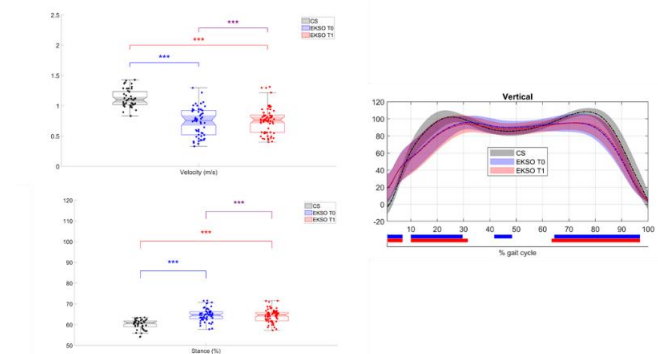


## Conclusions

These results suggest that both therapies were able to improve the spatiotemporal parameters. In particular Ekso provided better improvements on the vertical GRF by promoting upright walking and improving load through the lower limbs, supporting a more natural gait. However, differences in joint kinematics and muscle activation were not observed. We can speculate that these variables might need longer therapy time to show significant improvements [6,7]. References

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