IJMSRI
International Journal of Medical Science Research and Innovations

Volume 2 Special Issue 1 (Feb) 2025, Article 23 (pp.57-58)
ISSN-3048-9067

Original Investigation | Neurology

Efficacy of Robot-Assisted Gait Training on Motor Dysfunction in Parkinson's Disease: A GRADE Assessed Systematic Review and Meta-Analysis

Janu Chhetri[1], Inisha Sapkota[1], Nirmal Paudel[2], Anurag Jha[3], Adesh Kantha[4], Munna William[2], Sushmita Bhandari[5], Hamza Muhammad Jafar[1], Hamza Muhammad Jafar[3], Muhammad Nabeel Saddique[3], MBBS, Javed Iqbal

MBBS, Department of Medicine, Fatima Jinnah Medical University[1], MBBS, Department of Medicine, Nishtar Medical University[2], MBBS, Department of Medicine, King Edward Medical University[3], MBBS, Department of Medicine, Institute of Medicine[4], MBBS, Department of Neurology, University of Alabama[5], R.N[6]

Key Points

Question:
How effective is Robot-Assisted Gait Training (RAGT) in improving motor function in Parkinson's Disease (PD) patients?
Does RAGT provide superior benefits compared to conventional rehabilitation methods?

Findings:
A systematic review of 21 RCTs (793 patients, aged 65-78) assessed RAGT's impact on motor dysfunction in PD.
Significant statistical improvements were found in UPDRS III, 10MWT, 6MWT, BBS, walking speed, stride length, and ABC scores.
No significant differences were observed for TUG, step length, or cadence.
Despite statistical efficacy, only UPDRS III showed clinically meaningful improvements.

Meaning:
RAGT demonstrates statistical benefits in gait and motor function in PD but has limited clinical impact.
Further high-quality studies are required to assess long-term effectiveness and optimize clinical applications.

Abstract

Importance:
Parkinson's disease (PD) is one of the major neurodegenerative disorders with motor symptoms tremor, rigidity, bradykinesia, postural instability and gait dysfunction.
Robot-assisted gait training (RAGT) is a promising technique aimed at improving motor function in PD. However, its effectiveness compared to conventional rehabilitation remains debated.

Objective:
To evaluate RAGT's clinical effectiveness on PD motor function.

Data source:
A comprehensive search was conducted across PubMed, Embase, Web of Science, and Cochrane Library up to May 2024.Keywords "Parkinson's Disease", "Motor Dysfunction", "Gait", "Robot-assisted gait training."

Study Selection:
Inclusion criteria: 1) Adults with PD with motor dysfunction 2) Randomized controlled trials (RCTs). Exclusion Criteria: 1) not published in peer-reviewed journals, grey literature, or conference abstracts 2) duplicate studies 3) study designs like case reports, reviews, letters to editor, and observational studies.

Data Extraction:
All the outcomes were represented as their mean difference (MD) with 95% confidence intervals (CI) using the random-effects model following the PRISMA guideline. The I2 and chi2 statistics were employed to evaluate heterogeneity. All the calculations were performed using RevMan 5.4 and R Studios 4.3.3. Risk of Bias assessment was performed using RoB2.0 tool, and the certainty of the evidence using GRADE assessment.

Outcomes:
Unified Parkinson's Disease Rating Scale (UPDRS III), Timed Up and Go (TUG), Berg Balance Scale (BBS), Activities-Specific Balance Confidence Scale (ABC), walking speed (WS), 6-minute walk test (6MWT), 10-Meter walk test (10MWT), stride length, step length, and cadence.

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Results:
A total of 21 RCTs involving 793 patients from 65 to 78 years of age; having Hoehn and Yahr score ranging between 1 and 4, were included in this review. RAGT significantly improved UPDRS III(MD -3.34, 95% CI -5.02 to -1.66, P<0.0001, I2=69%), 10-MWT (MD 0.07, CI 0.03 to 0.11, P=0.001, I2=16%), 6 MWT (MD 18.10, CI 2.89 to 33.32, P=0.02, I2=90%), BBS(MD 2.95, CI = 1.75 to 4.14, P<0.00001, I2=63%), walking speed (MD 3.20, CI 1.81 to 4.59, P<0.00001, I2=0%), stride length (MD 5.26, CI 3.29 to7.23, p<0.00001, I2=0%) and ABC (MD7.18, CI 4.45 to 9.91, P<0.00001, I2=11%). However, only UPDRS III showed clinical significance. No significant differences for Timed Up and Go (MD -0.58, CI -1.17 to 0.02, P=0.06, I2=7%), step length (MD 4.54, CI -1.08 to 10.17, P=0.11, I2=60%) , and cadence (MD 4.00, CI -3.19 to 11.19; P=0.28, I2=70%) were observed.

Conclusion:
RAGT shows statistical efficacy, but modest clinical impact. More high-quality studies are needed.

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Article Information

Accepted for Publication: December 24-2024
Published: February 13-2025.

Corresponding Author: Janu Chhetri, MBBS, Department of Medicine, Fatima Jinnah Medical University.
Acknowledgment: - MedVentures (CPD no.-#784331) for providing financial support for Publishing, Alte University.