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## **The effects of transcranial direct current stimulation on gait in patients with Parkinson's disease: A systematic review**

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**Background:** Gait problems are an important symptom in Parkinson's disease (PD), a progressive neurodegenerative disease. Transcranial direct current stimulation (tDCS) is a neuromodulatory intervention that can modulate cortical excitability of gait-related regions. Despite an increasing number of gait-related tDCS studies in PD, the efficacy of this technique for improving gait has not been systematically investigated yet. Here, we aimed to systematically explore the effects of tDCS on gait in PD, based on available experimental studies.

**Methods:** Using the PRISMA approach, PubMed, Web of Science, Scopus, and PEDro databases were searched for randomized clinical trials assessing the effect of tDCS on gait in patients with PD.

**Results:** 18 studies were included in this review. Overall, tDCS targeting the motor cortex and supplementary motor area bilaterally seems to be promising for gait rehabilitation in PD. Studies targeting the dorsolateral prefrontal cortex or cerebellum showed more heterogeneous results. More studies are needed to systematically compare the efficacy of different tDCS protocols, including protocols applying tDCS alone and/or in combination with conventional gait rehabilitation treatment in PD.

**Conclusions:** tDCS is a promising intervention to improve gait in PD. Anodal tDCS over motor areas showed a positive effect on gait, but stimulation of other areas was less promising. However, heterogeneities of methods and results make it difficult to draw firm conclusions and require systematic exploration of tDCS protocols to optimize efficacy.

**Keywords:** transcranial direct current stimulation, gait, Parkinson's disease

### **Recent Publications**

1. Pol F, Baharlouei H, Taheri A, Menz HB, & Forghany S (2021). Foot and ankle biomechanics during walking in older adults: A systematic review and meta-analysis of observational studies. *Gait Posture*. 26 (89),14-24.
2. Pol F, Salehinejad MA, Baharlouei H, & Nitsche MA (2021). The effects of transcranial direct current stimulation on gait in patients with Parkinson's disease: A systematic review. *Translational Neurodegeneration*, 10 (1), 22.
3. Esfandiari A., Mostamand J., & Baharlouei H. (2020). The Effect of Quadriceps Kinesiotaping on the Dynamic Balance of Young Healthy Women After Fatigue: A Randomized Controlled Trial. *Journal of Bodywork and Movement Therapies*, 24(4), 462-467.

### **Biography**

Hamzeh Baharlouei is teaching courses in Neurological Physiotherapy at Isfahan University of Medical Sciences for the past 10 years. He recently graduated from Ahvaz Judishapur University of Medical Sciences in Ahvaz, Iran where he researched the effect of transcranial direct current stimulation (tDCS) on balance in older adults. On top of other publications his research in this field has been resulted in two systematic reviews on the effect of tDCS on balance in healthy young and older adults and on gait in patients with Parkinson's disease, the results of which have been published in *Neurophysiologie Clinique* and *Translational Neurodegeneration*. His research interests lie in older adults, neurological physiotherapy, gait and balance, and neuromodulation.

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