

# Examining the Clinical Effectiveness of Rhythmic Auditory Stimulation in Dynamic Balance and Gait Training in Patients with Parkinson's Disease: a Systematic Review

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## Background and Objectives

This study's purpose was to systematically review randomized controlled trials evaluating the effectiveness of rhythmic auditory cues with gait training for patients with Parkinson's disease (PD). Rhythmic Auditory Cues (RAC) combined with physical therapy may, theoretically, improve gait outcomes made with current treatment. This systematic review was designed to evaluate current research on the use of rhythmic auditory cues and music therapy in the physical rehabilitation of patients with PD stage I-IV on the Hoehn and Yahr (H&Y) scale.

## Methods

CINAHL complete, Cochrane, MEDLINE, and SportsDiscus databases were searched through EBSCOhost. Studies were accepted if they were randomized controlled trials (RCTs), investigated the effects of external rhythmical cueing on gait and balance, were published within 15 years, and scored 7 or above on the PEDro scale. After duplicates, non-RCTs, and articles unrelated to RACs or Parkinson's were removed, 7 articles were assessed for eligibility using the PEDro scale. One RCT did not receive a 7 out of 10 rating on the PEDro scale and was excluded, leaving 6 studies for review.

## Results

Six RCTs were reviewed that investigated the effects of auditory cueing on gait and balance in patients with Parkinson's Disease. Walking speed was measured in 5 of the RCTs. Outcome measures used included the 10-meter walk test, 6-meter walk test, Dynamic Gait index (DGI), Rapid Step-Up Test, Force Plate Analysis, and the Posturo-Loocomotion Manual Method (PLM). Balance was measured in 4 of RCTs. Outcome measures used consisted of the Berg Balance test, the Push and Release test, MiniBest, Smart Equitest, Timed Up-and-Go (TUG), Functional Gait Assessment (FGA) and the Tinetti balance assessment tool. Rhythmic Auditory Cues were found to improve dynamic balance, motor function, and gait.

## Discussion and Conclusion

Applying RAC along with physical therapy should be considered in patients just as any other intervention or modality. Current research is mostly limited with weak study designs, inconsistent intervention patterns, and small sample sizes. Future research on RAC for patients with Parkinson's disease should use a strong research design and evaluate carryover to functional independence and the effect on participation. The studies suggested that gait and balance training should be started early, as falls occur clinically when the patient has already exhausted all compensatory resources used by the nervous system. Based on the research, there seems to be sufficient evidence for the use of RAC in the clinical setting for retraining gait and balance in patients with Parkinson's disease. However, more research on the intervention is needed.

### Summary of Studies

Study	PEDro Scores	Subjects	Intervention	Outcome Measures	Results
Da Costa Capato	8/10	Idiopathic PD, Stage II or III on H&Y scale, Mini Mental Status Examination score > 24, presented with fall history in the past months, able to ambulate independently indoors without aid.	An exercise program aimed at improving balance for 5 weeks with two sessions a week, 45 min per session, consisting of general physical therapy exercises. Sessions divided into 3 parts: 5 minute warm up, 30 minute motor training, and a 10 minute cool down. RAC group received cues via a metronome.	Berg Balance Scale, postural stress test, push and release test, Mini-BEST, TUG, Freezing of Gait Questionnaire, UPDRS, FES-I	RAC significantly decreased the fear of falling in older adults better than a wellness education program ( $p < 0.001$ at 8 months) and ( $p < 0.001$ at the end of the study)
Harro	7/10	19-89 years old, diagnosis of idiopathic PD, stage I-III on the H&Y scale, ability to walk continuously without physical assistance for five minutes with or without an assistive device, stable PD medication schedule and dosing over the past month as reported by the participants neurologist, and functional vision and hearing sufficient to perceive cues with or without aides/glasses	Auditory-cued over-ground locomotor training on an indoor track while listening to a personalized music playlist set at subject-specific beats per minute (bpm). Three, 30 minute training sessions per week for 6 weeks.	CGS, FGS based on the 10-meter walk test, 6MWT, FGA, Rapid Step-Up Test, Berg Balance Scale, Standardized measures on the SMART EquiTest System (Limits of Stability, Motor Control, and Sensory Organization Tests)	Within-group training effects showed significant gains in CGS, 6MWT, and FGA for the RAC group. Retention effects found at 3 month follow-up for all gait measures in RAC group. No statistically significant differences on gait measures were found between groups
Kadaver	7/10	Idiopathic PD stage II-IV on H&Y, stable drug use, independent in stance and walk with/without assistive device and able to differentiate auditory cues	Subjects performed external cued stepping from RAC at various speeds. All participants trained 3x/week for 45-60 minutes for 6 weeks following recommendations to enhance motor control and progression.	DGI, UPDRS, Tinetti, TUG, FOGQ	Significant improvements in DGI, TUG, Tinetti, and FOG in the RAC group. Maintained improvements 4 weeks post study. Control group showed significant improvement in the TUG

Key: H&Y = Hoehn & Yahr scale, BBS = Berg Balance Scale, TUG = Timed up and Go, UPDRS = unified Parkinson's disease rating scale, FES-I = Falls Efficacy Scale-International, CGS = Comfortable gait speed, 6MWT = 6 minute walk test, FGA = functional gait assessment, DGI = Dynamic gait index, FOGQ = Freezing of Gait Questionnaire, FGS = Fast Gait Speed

## References

- Harro C, Shoemaker M, VanHaistma R, et al. The effects of speed-dependent treadmill training and rhythmic auditory-cued overground walking on gait function and fall risk in individuals with idiopathic Parkinson's disease: A randomized controlled trial. *Neurorehabilitation* [serial online]. March 2014;34(3): 557-572
- Ellis T, Goede CJ, Feldman R, Wolters EC, Kwakkel G, Wagenaar RC. Efficacy of a physical therapy program in patients with Parkinson's disease: A randomized clinical trial. *Arch Phys Med Rehabil* 2005; 4: 626/32.
- Thaut MH, McIntosh GC, Rice RR, Miller RA, Rathbun J, Brault JM. Rhythmic auditory stimulation in gait training for Parkinson's disease patients. *MovDisord* 1996; 11: 193/200.
- Arias P, Cudeiro J. Effect of Rhythmic Auditory Stimulation on Gait in Parkinsonian Patients with and without Freezing of Gait. *Plos ONE* [serial online]. March 2010;5(3):1-8.
- da Costa Capato T, Tornai J, Ávila P, Barbosa E, Piemonte M. Randomized controlled trial protocol: balance training with rhythmical cues to improve and maintain balance control in Parkinson's disease. *BMC Neurology* [serial online]. September 8, 2015;15(1):1-7
- PEDro scale (English). PEDro. Available at: <http://www.pedro.org.au/english/downloads/pedro-scale/>. Accessed April 27, 2016

Additional references available upon request.

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