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Non-gait related benefits of auditory cueing in Parkinson's Disease

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Abstract

Parkinson's disease (PD) is a neurodegenerative disorder that targets mainly dopaminergic neurons of the basal ganglia. PD is characterized by motor symptoms typically leading to dysfunctional gait. External rhythmic auditory cues have shown beneficial effects on gait kinematics in PD patients. These effects are likely to be mediated by a general-purpose neuronal network including a cerebello-thalamo-cortical circuit involved in stimulus-driven allocation of attention (i.e., by entrainment), temporal prediction, and sensorimotor synchronization. This implies that the benefits of auditory rhythmical cueing may extend beyond gait functions, a possibility which has not been assessed so far. In the current study, we investigate whether auditory cueing has a positive effect on perceptual and motor timing. Fifteen PD patients were submitted to a standard auditory cueing program (3 times/week for 30 min, for one month). Gait performance was evaluated using motion capture. In addition, motor (via tapping tasks) and perceptual timing abilities were assessed using the Battery for the Assessment of Auditory Sensorimotor and Timing Abilities (BAASTA). The patients were evaluated before the program, immediately after, and one month after the therapy. Their performance was compared to that of healthy age-matched controls. Improved gait kinematics was observed as a result of the therapy and persisted one month later. Interestingly, these benefits extended to timing abilities. Improved duration discrimination, enhanced detection of misaligned sounds to the beat of music and benefits in paced tapping to a metronome were observed. Our findings indicate that the effects of auditory cueing in PD extend to both perceptual and motor timing. Sensorimotor coupling is likely to foster brain plasticity leading to non-gait related effects. These findings raise the possibility of applying cueing therapy for the rehabilitation of timing and motor functions in other basal ganglia disorders (e.g., Huntington's disease, stroke).

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