References
[1] Herholz SC, Zatorre RJ. Musical training as a framework for brain plasticity: behavior, function, and structure. Neuron 2012;76(3):486–502.
[2] Rodrigues AC, Loureiro MA, Caramelli P. Long-term musical training may improve different forms of visual attention ability. Brain Cogn 2013;82(3):229–35.

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Posters

P039-e
Nordic walking can improve dynamic stability of human gait in Parkinson disease

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Objectives Activating the upper body during walking, Nordic walking (NW) may be used as an external cueing to improve spatiotemporal parameters of gait, such as stride length or gait variability, in Parkinson disease (PD). Structured gait variability, revealed by the presence of long-range autocorrelations (LRA), was associated to dynamic stability of gait. Dynamic stability has been defined as the ability to maintain functional locomotion despite the presence of internal or external disturbances, which is a feature of healthy locomotor system. This study aimed to study beneficial effects of NW on dynamic stability of gait in PD.
Materials and method After three sessions of practice, 14 mild to moderate PD patients performed 2 × 12 min overground walking sessions (with and without pole in a randomized order) at a comfortable speed. Gait cadence, gait speed, stride length and temporal organization (i.e. LRA) of stride duration variability were studied on 512 consecutive gait cycles using a uni-dimensional accelerometer placed on the malleola of the most affected side. The presence of LRA was based on scaling properties of the series variability (Hurst exponent) and the shape of the power spectral density (α exponent). In order to assess beneficial effects of NW on PD gait, a paired *t*-test was used ($p < 0{,}05$).
Results All patients presented LRA in all series of walking pattern. However, Hurst and α exponent were significantly higher during NW ($p \leq 0.001$). While gait speed remained unchanged between two walking sessions ($p = 0.320$), gait cadence decreased and stride length increased significantly ($p = 0.009$ and 0.003 for gait cadence and stride length, respectively).
Discussion This study demonstrates the presence of LRA during Nordic walking and that way of walking can improve the dynamic stability of gait in Parkinson disease. Such improvement could be due to the upper body rhythmic movements acting as rhythmical external cue to bypass their defective basal ganglia circuitries. Therefore, Nordic walking may constitute a powerful way to manage gait disorder in PD.
Keywords Parkinson disease; Nordic walking; Dynamic stability; Long-range autocorrelations; Gait variability; Spatiotemporal gait parameters; External cue
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P040-e
Does metronome really help timing gait in Parkinson's disease?

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Objectives Unstructured gait variability is a hallmark of timing gait disorders of Parkinson's disease (PD). Recently, complex temporal structure of stride duration variability has been demonstrated in healthy gait pattern, displaying long-range autocorrelations (LRA). Conversely, the breakdown of such temporal organization was associated to dynamic instability in PD. To improve timing gait in PD, synchronization of walking with rhythmic auditory stimulation (RAS) like music or metronome is largely used in clinical settings. However, while structure of RAS can modulate LRA in healthy gait pattern, it remains unknown in PD.
Materials and method Patients performed overground walking trials at a comfortable speed while listening different structures of RAS (counterbalanced order across patients). Each structure was adapted to the gait cadence of each patient as previously measured in a 10-meter walking test. The RAS varied in term of fluctuation of the metronome period in the sound sequence, yielding four conditions: strictly metronomic, randomly fluctuating around the metronome period, fluctuating according to an LRA structure (Hurst exponent = 0.80) and no auditory stimulus. Cadence, speed, stride length, temporal organization (LRA) and magnitude of stride duration variability were measured on 512 consecutive gait cycles. The presence of LRA was based on scaling properties of the series variability (Hurst exponent) and the shape of the power spectral density (α exponent). Those measures were compared across the four conditions using a one-way repeated ANOVA.
Results/Discussion Our results show that temporal organization of PD gait may be modulated using different auditory structures. Spearman's coefficients indicate adequate correlations between LRA of gait and auditory cue. This matching indicates strong adaptation and synchronization of the gait to the RAS in those patients. However, LRA were systematically lower during auditory conditions compared to spontaneous walking session. Furthermore, magnitude of stride duration variability, walking cadence, walking speed, stride length were not statistically different across different conditions. Consequently, strictly metronomic auditory stimuli do not seem to be an optimal way to improve timing gait in PD, as it induces the disappearance of LRA. Future work will investigate whether structured auditory stimuli induce gait improvement in PD.
Keywords Parkinson disease; Metronome; Rhythmic auditory stimulation; Long-range autocorrelations; Gait variability; Spatiotemporal gait parameters; External cue
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