Scopus

Documents

Dierick, F.[a b c] , Vandevoorde, C.[d] , Chantraine, F.[a] , White, O.[e] , Buisseret, F.[b d f]

Benefits of nonlinear analysis indices of walking stride interval in the evaluation of neurodegenerative diseases
(2021) *Human Movement Science*, 75, art. no. 102741, .

DOI: 10.1016/j.humov.2020.102741

[a] Centre National de Rééducation Fonctionnelle et de Réadaptation – Rehazenter, Laboratoire d'Analyse du Mouvement et de la Posture (LAMP), Luxembourg, 2674, Luxembourg
[b] Centre de recherche et de formation (CeREF Technique), Haute Ecole Louvain en Hainaut, Mons, 7000, Belgium
[c] Faculté des Sciences de la Motricité, Université catholique de Louvain, Louvain-la-Neuve, 1348, Belgium
[d] Laboratoire Forme et Fonctionnement Humain (FFH), Haute Ecole Louvain en Hainaut, Montignies-sur-Sambre, 6061, Belgium
[e] Université de Bourgogne INSERM-U1093 Cognition, Action, and Sensorimotor Plasticity, Campus Universitaire, BP 27877, Dijon, 21078, France
[f] Service de Physique Nucléaire et Subnucléaire, université de Mons, UMONS Research Institute for Complex Systems, Mons, 7000, Belgium

Abstract
Indices characterising the long-range temporal structure of walking stride interval (SI) variability such as Hurst exponent (H) and fractal dimension (D) may be used in addition to indices measuring the amount of variability like the coefficient of variation (CV). We assess the added value of the former indices in a clinical neurological context. Our aim is to demonstrate that they provide a clinical significance in aging and in frequent neurodegenerative diseases such as Parkinson's disease, Huntington, and amyotrophic lateral sclerosis. Indices assessing the temporal structure of variability are mainly dependent on SI time series length and algorithms used, making quantitative comparisons between different studies difficult or even impossible. Here, we recompute these indices from available SI time series, either from our lab or from online databases. More precisely, we recompute CV, H, and D in a unified way. The average SI is also added to the measured parameters. We confirm that variability indices are relevant indicators of aging process and neurodegenerative diseases. While CV is sensitive to aging process and pathology, it does not discriminate between specific neurodegenerative diseases. H, which measures predictability of SI, significantly decreases with age but increases in patients suffering from amyotrophic lateral sclerosis. D, catching complexity of SI, is correlated with total functional capacity in patients with Huntington's disease. We conclude that the computation of H complements the clinical diagnosis of walking in patients with neurodegenerative diseases and we recommend it as a relevant supplement to classical CV or averaged SI. Since H and D indices did not lead to the same observations, suggesting the multi-fractal nature of SI dynamics, we recommend to open clinical gait analysis to the evaluation of more parameters. © 2020 Elsevier B.V.

Author Keywords
Clinical indexes; Fractal analysis; Gait pattern

Index Keywords
adult, algorithm, amyotrophic lateral sclerosis, Article, clinical feature, comparative study, controlled study, degenerative disease, female, fractal analysis, human, Huntington chorea, major clinical study, male, Parkinson disease, practice guideline, stride length, time series analysis, walking, aging, degenerative disease, gait, middle aged, pathophysiology, principal component analysis, procedures; Adult, Aging, Algorithms, Female, Fractals, Gait, Gait Analysis, Humans, Huntington Disease, Male, Middle Aged, Neurodegenerative Diseases, Parkinson Disease, Principal Component Analysis, Walking

Correspondence Address
Dierick F.; Centre National de Rééducation Fonctionnelle et de Réadaptation – Rehazenter, Luxembourg; email: frederic.dierick@rehazenter.lu

Publisher: Elsevier B.V.

ISSN: 01679457
CODEN: HMSCD
PubMed ID: 33310379
Language of Original Document: English
Abbreviated Source Title: Hum. Mov. Sci.
2-s2.0-85097467020
Document Type: Article
Publication Stage: Final
Source: Scopus

ELSEVIER

Copyright © 2022 Elsevier B.V. All rights reserved. Scopus® is a registered trademark of Elsevier B.V.

RELX Group™