

MovementRx: Versatile clinical movement analysis using Statistical Parametric Mapping

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Keywords: SPM1D, Statistical Parametric Mapping, Biomechanics, Clinical Gait Analysis, Gait Dynamics, time series analysis

Posted Date: June 29th, 2021

DOI: <https://doi.org/10.21203/rs.3.rs-625800/v1>

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Abstract

Background: Clinical gait analysis is an important field of biomechanics that is influenced by subjectivity, which can lead to type I and II errors. Statistical Parametric Mapping (SPM) is a classical hypothesis testing method that can operate on all measured joint dynamics simultaneously, thereby overcoming errors associated with subjective reduction of these complex data and providing a quantitative and coherent assessment.

Results: We present MovementRx, the first gait analysis modelling application that models joints in 3 degrees of freedom. It is a python-based versatile GUI-based movement analysis decision support system, that provides a holistic view of all lower limb joints fundamental to the kinematic/kinetic chain (i.e., related to functional gait). It utilizes the time varying statistical tool SPM1D combined with a visualizing software. The user can cascade the view from single 3D multivariate result down to specific single joint individual scalar component of movement in one dimension. It exports its API as a library for use by another python application or command line.

We also presented a case study of a unilateral knee osteoarthritis (OA) patient with otherwise undetected contralateral OA predisposition. The intervention elevated the patient's moments on the right (affected) limb, but it led to adverse compensation on the left (contralateral) limb, leaving the patient likely to develop OA in her left limb in the future, unless immediate preventive and / or corrective actions were taken.

Conclusions: MovementRx is a clinical gait analysis tool for that provides objective representation of the magnitude of statistical effect of all relevant joints in a simple, coherent, objective, and visually intuitive manner. No other software correctly model joints in 3 degrees of freedom.

Full Text

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