Title: Quantification characteristics of digital spiral analysis for understanding the relationship among tremor and clinical measures in persons with multiple sclerosis

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PII: S0165-0270(18)30178-X
DOI: https://doi.org/10.1016/j.jneumeth.2018.06.016
Reference: NSM 8038

To appear in: *Journal of Neuroscience Methods*

Received date: 26-1-2018
Revised date: 11-6-2018
Accepted date: 12-6-2018

Please cite this article as: DelMastro HM, Ruiz JA, Gromisch ES, Garbalosa JC, Triche EW, Olson KM, Lo AC, Quantification characteristics of digital spiral analysis for understanding the relationship among tremor and clinical measures in persons with multiple sclerosis, *Journal of Neuroscience Methods* (2018), https://doi.org/10.1016/j.jneumeth.2018.06.016

Article Type: Research Paper

Title: Quantification characteristics of digital spiral analysis for understanding the relationship among tremor and clinical measures in persons with multiple sclerosis

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Highlights

- Segment rate (SEGRT) is a novel measure to quantify tremor for a fine motor task.
- SEGRT has stronger sensitivity than the manual Archimedes Spiral.
- Objective measure of tremor in a large cohort of persons with Multiple Sclerosis.

Abstract

Background: Multiple sclerosis (MS) is a degenerative neurological condition causing demyelination and neuronal loss. Tremor, a symptom of MS, is prevalent in 45.0-46.8% NARCOMS registrants. Although several tools to measure tremor exist, few outcomes are quantitative or regularly utilized clinically.

New Method: Introduction of a novel adaptation of the digital spiral drawing to find a quick, sensitive, and clinically useful technique, to predict tremor in persons with MS (pwMS). Digital spiral measures included: Segment Rate (SEGRT), Standard Deviation (SD) of Radial Velocity (VSD-R), SD of Tangential Velocity (VSD-T), SD of Overall Velocity (VSD-O), Mean Drawing Velocity (MNV-O) and Mean Pen Pressure Acceleration (MNA-P). Digital spiral measures were compared with the manual Archimedes Spiral (AS) drawing and the following clinical measures: Finger-Nose Test (FNT), presence of visually observed intention tremor (VOT), Nine-Hole Peg Test (NHPT), and Box and Block Test (BBT).

Results: All clinical measures utilized demonstrated significant relationships with all digital variables, except VSD-R. The forward-stepwise regression revealed BBT accounted for the most variance, followed by SEGRT.

Comparison with Existing Methods: SEGRT is more sensitive in detecting VOT and better for quantifying tremor than AS. BBT and SEGRT are optimal predictive measures for tremor.

Conclusions: SEGRT has stronger sensitivity and negative predictive value than AS in detecting VOT. All clinical measures (NHPT, FNT, BBT, and AS) were significantly associated with the digital variables (SEGRT, VSD-T, VSD-O, MNV-O, and MNA-P) except for VSD-R. After