The use of Inertial Sensor Based System for Objective Assessment of Tremor in Parkinson's Disease

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Abstract

Introduction: Parkinson's disease (PD) is a prevalent neurodegenerative condition characterized by the degeneration of dopaminergic neurons, with a significant impact on public health, particularly among the elderly. Despite the criterias for clinical diagnosis, there is no standardized approach for early diagnosis or continuous and objective assessment of tremor progression in PD. The current methods rely on subjective and limited assessments. The aim of this study is to evaluate the use of inertial sensor-based systems in assessing tremor progression and fluctuations in PD.

Method: This study involved 12 PD patients and 12 healthy controls, assessed with the Unified Parkinson's Disease Rating Scale (UPDRS) and the TREMSEN system, a inertial sensor-based device developed for high-resolution, objective quantification of tremor in clinical research.

Results: The Kruskal-Wallis test revealed statistically significant differences in tremor amplitude ($p < 0.05$) between at least two of the groups (PD-OFF, PD-ON, controls) on both sides for all three spatial axes. In anteroposterior axis, Wilcoxon tests for multiple comparisons demonstrated significant differences observed for all comparison pairs during the posture maintenance task, the second resting period, the wrist adduction-abduction task, and the third resting period on both sides ($p < 0.05$). Spearman's correlation for tremor amplitude exhibited a significant correlation with the clinical assessment scale ($p < 0.05$).

Discussion: The results indicated that TREMSEN was effective in differentiating tremor between the groups, especially during rest and postural tasks, proving to be useful for the diagnosis and monitoring of PD. The correlation between tremor magnitude and the UPDRS scale suggests that the system can objectively reflect tremor severity.

Conclusions: The findings reinforce the usefulness of TREMSEN in quantifying tremor and indicate the relevance of future studies on motor fluctuations with inertial sensors.

References

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