Evaluation of Gastric Motility of Parkinsonâ€™s Disease Patients Based on a Novel Wearable Device and Time-Frequency Analysis

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Objective:
The aim of this study was to present an alternative approach to record and process electrogastrography (EGG) data and evaluate its effectiveness in analyzing preprandial/postprandial gastric motility of Parkinson's disease (PD) patients.

Background:
Gastrointestinal (GI) dysfunctions are common non-motor PD symptoms. EGG is a non-invasive way for cutaneous measurement of gastric myoelectrical activity that has been used for the identification of gastric motility impairment.

Design/Methods:
The study included six PD patients (mean age: 67 years, mean PD duration: 10.5 years) and six age-matched healthy controls. EGG was recorded by a novel comfortable, lightweight device, namely smart belt, that captures bipolar EGG with reference channel at 1KHz sampling frequency. Two 30-min-long EGG recordings were captured after a 6-hour fasting period, before/after a standardized meal. Analysis of EGG signals included, among others, time-frequency analysis via continuous wavelet transform (CWT) for augmented low frequency resolution, and calculation of features: dominant frequency/power (DF/DP), post-/pre-prandial DP ratio (DPR) and percentage of normogastria/bradygastria/tachygastria (PN/PB/PT).

Results:
Values are expressed as mean±SD. Statistically significant differences (p values <0.05 for Mann-Whitney U-test) between the two groups were identified primarily at the post-prandial period, i.e., PN (patients: 53.3±7.1; healthy: 85.6±5.4), PB (patients: 35.6±5.5; healthy: 10.8±4.4), DP (patients: 0.9±0.03; healthy: 0.14±0.02), DF (patients: 2.1±0.3; healthy: 2.95±0.2). On the contrary, PN (patients: 40.3±4.1; healthy: 76.6±7.1) and DP (patients: 0.07±0.02; healthy: 0.1±0.01) differ significantly at the pre-prandial period. Furthermore, DPR is significantly higher for the healthy subjects (2.03±0.47) than for the patients (1.2±0.36).

Conclusions:
The aforementioned results indicate that PD patients exhibit significant alterations in gastric motility compared to healthy individuals. Consequently, they indisputably verify the competence of the proposed scheme. i.e., the smart belt along with the proposed CWT-based data processing pipeline are capable to record and analyze effectively EGG data in order to identify gastric motility impairment related to PD.