# Response of Ventricular Repolarization to Simulated Microgravity Measured by Periodic Repolarization Dynamics using Phase-Rectified Signal Averaging

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**Introduction:** Simulated microgravity by Head-Down Bed Rest (HDBR) induces alterations on the autonomic and cardiovascular systems. Periodic Repolarization Dynamics (PRD) is a recently proposed index used to quantify sympathetic modulation of ventricular repolarization by measuring low-frequency oscillations in the angle of the T-wave of the electrocardiogram (ECG).

**Aims:** To compare two methods, namely Continuous Wavelet Transform (CWT) and Phase Rectified Signal Averaging (PRSA), for PRD calculation and to quantify changes in PRD in response to simulated microgravity.

**Materials and Methods:** 12-lead ECG signals of 22 healthy male volunteers enrolled in a long-term (60 days) HDBR study were available for this study. 5-minute segments at baseline and during tilt test (TTT) before (PRE) and after (POST) HDBR were selected from each subject. PRD was computed from the series of angular variations between consecutive T-waves by CWT and PRSA techniques.

**Results:** High significant rank correlation was found between the two methods for calculating the PRD index: Spearman's correlation coefficient $\rho = 0.93$ ($p = 1.13 \cdot 10^{-55}$) and Kendall's $\tau = 0.79$ ($p = 9.42 \cdot 10^{-39}$). TTT led to remarkable increases in PRD, both at PRE and POST, with any of the evaluated methods. Importantly, PRD values at POST were greater than those at PRE. In particular, when evaluated at the beginning of TTT, a statistically significant ($p < 0.01$) increase was found in POST with respect to PRE, 1.40 [1.10] deg vs 0.97 [0.90] deg (median [IQR]), as measured by PRSA.

**Conclusions:** PRD values calculated by CWT and PRSA are equivalent in terms of rank statistics. Exposure to simulated microgravity and tilt test both induce changes in sympathetically-modulated ventricular repolarization that can be measured by PRSA analysis of PRD.