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Finger Plethysmography and Heart Rate Monitors Provide Accurate Resting Heart Rate Variability Assessments vs Electrocardiography

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Heart rate variability (HRV) is a commonly used non-invasive assessment of autonomic nervous system function. The technique relies on accurate determination of cardiac interval duration. The electrocardiogram (ECG) is the established gold standard, but continuous heart rate monitors, and finger plethysmography can also be used. However, some question the validity of these other methods. **PURPOSE:** To compare beat-by-beat cardiac interval duration and HRV derived from ECG (control) and experimental measurements of chest heart rate monitor spikes (Polar), systolic (SBP) and diastolic blood pressure (DBP) peaks and nadirs, and blood pressure derivative peaks (dy/dx). **METHODS:** Five healthy subjects (age 21±2yrs; M 1, W 4) had a single lead ECG, chest heart rate monitor strap, and a finger continuous noninvasive blood pressure monitor attached to them. Subjects laid in the supine position for ≈5 minutes prior to any data collection. Once in a rested state, 5 minutes of data were collected. Root mean square error (RMSE) of the beat-by-beat cardiac interval duration was compared between techniques using a one-way ANOVA and Tukey's post hoc. Heart rate variability was assessed using ECG, Polar, SBP, DBP, and blood pressure dy/dx data. HRV indices (total included beats, average RR interval, standard deviation of the RR interval, average heart rate, root mean square of successive differences in RR interval, percent of successive RR intervals differing by >50ms, low frequency (LF) power, high frequency (HF) power, and LF/HF power) were compared between the control and experimental techniques using Pearson correlations. **RESULTS:** Cardiac cycle RMSE compared to control was not significantly different ($p>0.05$) between Polar (0.039±0.027s), SBP (0.027±0.025s), and DBP (0.032±0.022s). However, dy/dx RMSE (0.112±0.039s) was significantly greater than all other techniques ($p<0.05$). Pearson correlations between ECG derived HRV indices and the other cardiac signals were significant (all $p<0.001$) with strong coefficient of determination (all $r^2 \geq 0.955$). **CONCLUSION:** All techniques assessed showed a very strong relationship with the gold standard signal (ECG) for various HRV indices. However, dy/dx exhibited significantly more error in detecting accurate cardiac interval durations than the Polar, SBP, and DBP signals.