**Supplementary material**

* 1. P**a**radigm control

As control paradigm for wavelet transform performance, we introduced a standard set of parameters offered by Kubios HRV 2.2 [1] (Poincaré scatter plot parameters SD1 and SD2). Kubios HRV 2.2 is developed by the Biosignal Analysis and Medical Imaging Group, Department of applied Physics of the University of Eastern Finnland. The Poincaré plot is achieved by plotting one RR interval versus its consecutive one resulting in a plot of RRj+1 over RRj with j={1…N} | N Є ℕ. To this scatter-plot an ellipse is fitted oriented along the Line-Of-Identity (which is the line where RRj+1= RRj). The width of that fitted ellipse corresponds to SD1 whereas the length is SD2 [1]. These two parameters have been proven to correlate with the activities of the two branches of the nervous system. SD1 has been shown to correlate with short term variability of the HRV which is mainly influenced by parasympathetic actions and SD2 correlates with long time HRV variability and is a measure for both sympathetic and parasympathetic activity [2,3].

SD1 and SD2 were employed in this paper as a primary indicator to test the wavelet transform results for validity. The assumption for verification was to prove a direct positive correlation between SD1 and scale and time averaged wavelet power in the HF band on the one hand and SD2 and the scale and time averaged wavelet power in the LF band on the other hand.

Correlation was examined for SD1 and SD2 compared with the scale and time averaged wavelet powers and .

The scale and time averaged wavelet power of the two ANS branches calculated by the wavelet transform show a strong correlation to SD1 and SD2. Correlation between SD1 and was 0.935 and correlation between SD2 and was 0.773, both statistically significant (p-value 0.01). These results match the correlations obtained by Hoshi et al (0.93 between SD1 and Kubios HF parameter and 0.80 between SD2 and Kubios LF parameter).

These data strongly support validity of wavelet transform for the calculation of autonomic activity.

* 1. Data processing

Each ECG data-set was represented by a (N x 2)-matrix with the timeline in the first and the ECG-signal in the second column for the N sampling points of the whole signal.

Every single ECG data-set was imported into MATLAB® (R2012a), denoised (wden) and corrected for baseline shift and artifacts like supraventricular extrasystoles.

By using the MATLAB® function *wden* (Daubechies wavelet DB4, level 4) with soft-thresholding the original signal was denoised [4,5] . The elimination of a possible baseline shift is crucial for the later R-Peak detection with hard-thresholding. A baseline shift was detected and eliminated by degrading the signal into wavelet approximations, reconstruction of the first eight wavelet-scales and the final subtraction of these eight reconstructed time courses from the original signal [6].

* 1. Wavelet analysis

Discrete scale averaged wavelet power for the two frequency bands of interest LF and HF is given by and (A3.1 and A3.2).

sj are the scales corresponding to the pseudofrequencies of the Morlet wavelet bordering the particular frequency band (LF, HF).

Total activity of the two ANS branches (and ) is calculated by averaging the discrete series and over time (Formula A3.3)

is calculated by replacement of by .

n1 and n2 are the two points in time standing for start and endpoint of an specific interval (e.g. n1=Start of HUT; n2=End of HUT)

Both branches (and ) together correspond to the total activity of the cardiac autonomic innervation. Therefore both entities were normalized to the total power of the ANS activity resulting in LFnu and HFnu given in normalized units (Formula A3.4).

HFnu is calculated by supplementing by in the enumerator of (A3.4).

Discrete time series LFnu[n] for an intuitive visualization of the momentary activity of ANS is given by A3.5.

The average of LFnu[n] is not equal to LFnu from A3.4 because of the distinct methods of normalization (see above) but the discrete time series LFnu[n] and HFnu[n] provide a visual aid in evaluating sympathetic and parasympathetic activity at every point in time.

**REFERENCES**

[1] Tarvainen MP, Niskanen J-P, Lipponen JA, Ranta-Aho PO, Karjalainen PA (2014) Kubios HRV--heart rate variability analysis software. *Comput Methods Programs Biomed* **113**, 210–220.

[2] Hoshi RA, Pastre CM, Vanderlei LCM, Godoy MF (2013) Poincaré plot indexes of heart rate variability: Relationships with other nonlinear variables. *Auton Neurosci Basic Clin* **177**, 271–274.

[3] Roy B, Ghatak S (2013) Nonlinear methods to assess changes in heart rate variability in type 2 diabetic patients. *Arq Bras Cardiol* **101**, 317–327.

[4] Alfaouri M, Daqrouq K (2008) ECG signal denoising by wavelet transform thresholding. *Am J Appl Sci* **5**, 276–281.

[5] Donoho D (1995) De-noising by soft-thresholding. *IEEE Trans Inf Theory* **41**, 613-627.

[6] Frau DC, Novák D (2000) Electrocardiogram baseline removal using wavelet approximations. *Proceedings of the 15th Biennial Eurasip Conference BIOSIGNAL*, pp. 136–138.