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Influence of age and gender on 5-min QT variability

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Temporal variations in ventricular depolarization and repolarization are quantifiable by analysis of the beat-to-beat variability of QT intervals (QTV). Indices from QTV and heart rate variability (HRV) are proven to be suitable for classification of cardiac patients’ risks stratification. Effects of age and gender on QTV indices are inconclusive or insufficiently explained. In this study, general age- and gender-related influences on short-term indices of QTV and HRV were investigated analyzing 5-min resting high-resolution ECG recordings of 1801 healthy subjects from the KORA S4 (Cooperative Research in German Region of Augsburg) survey. From ECG we extracted heart rate and QT time series. From these time series linear HRV indices (meanHR, SDNN, RMSSD, pNN50, and LFn) and QTV indices (QTVI_log, QTc, and QTintmean) were estimated. Effects of age and gender on indices of QTV and HRV were statistically analyzed (SPSS 21, Mann-Whitney U test) by comparison of four subject groups: YF and YM (young females and young males, 25-49 years), and EF and EM (elderly females and elderly males, 50-74 years). As expected, a gender-independent significant loss of HRV (at least p<0.0012, Bonferroni correction) with aging was confirmed by diminished values of SDNN, RMSSD and pNN50 in elderly subjects compared to young subjects. All QTV indices were considerably increased in elderly subjects indicating a general rise of QTV with increasing age most probably caused due to changes in the cardiovascular structure and function with aging. Gender influences on both HRV and QTV indices were less pronounced compared to age influences. QTc and meanHR were lower and LFn was higher in males than in females particularly in younger subjects (p<10^{-10}) but also in elderly subjects (p<0.0012). However, that could not be seen in the QTV-index QTVI_log.

In summary, we found a high significant age dependency of QT variability but no dependency on gender.
Moss-embroidered electrodes for an ECG monitoring shirt

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Cardiovascular disease (CVD) is the main cause of death in Europe. CVDs can be broken down in several pathologies, which can be identified through different arrhythmia profiles. Atrial Fibrillation (AF) is the most common arrhythmia and an important cause of morbidity, both in itself and due to the associated risk for stroke. This condition is responsible for more than 750,000 hospitalizations and 130,000 deaths each year. Undetected cardiac issues due to the lack of post-hospitalization monitoring demands relevant innovations in healthcare. The Eurostars CAST - Cardiac measuring Shirt for Telemedicine - project will create a T-Shirt with moss-embroidered textile electrodes to measure the patient’s ECG coupled with the appropriate post processing for cardiologists. The system allows for continuous real-time monitoring of patients that positively impact risk assessment and hospitalization. In this way CAST will address the growing cardiac problem with a seamless solution to facilitate the interaction between patients and cardiologists.

In this study, a suitable electroconductive thread for the development of moss-embroidered ECG electrodes was selected. According to the electrode requirements such as a washability of up to 40 wash cycles and a low electrical resistance of less than 3 Ω/100 mm to ensure a high ECG signal quality, six electroconductive threads were investigated with regard to their electrical resistance after 0, 5, 10, 20, 30 and 40 wash cycles (ISO 6330:2012) using four-terminal sensing. Three of the six threads with the lowest electrical resistance after up to 40 wash cycles were selected for the evaluation of the electrical resistance of moss-embroidered ECG electrodes using the same wash cycles. It was shown that the electrodes made of Shieldex® 117/17 2 ply HC+B from Statex Produktions- & Vertriebs GmbH, Bremen, Germany show promising results for being used as ECG sensors in the CAST T-Shirt.