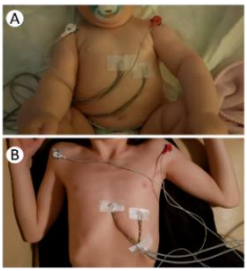
Seismocardiography On Infants And Kids

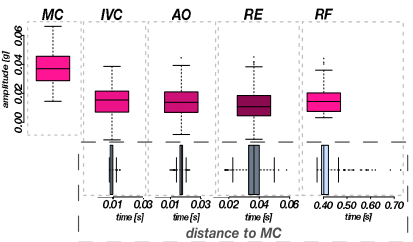
Nico Jähne-Raden[1], Henrike Gütschleg[1], Marie Cathrine Wolf[1], Stephan Sigg[2], Ulf Kulau[3]

[1]Peter L. Reichertz Institute, Hanover, Germany [2]Dept of Communications and Networking, Aalto, Finland, [3]DSI Aerospace, Bremen, Germany



Two subjects (A: infant, B: young child)

Seismocardiography (SCG) offers a variety of possibilities for cardiovascular diagnostics, especially in long-term monitoring. Unfortunately, little information is available about changes in SCG-signal-morphology over the life course, as well as differences in different age groups. Physiologically, the change in the human body and notably in the heart has been extensively investigated with increasing age (e.g. doubled oxygen demand, heart size ratios differs). From birth to adolescence, the resting heart rate drops (about twice as high in new-borns) and the ejection volume increases as the body grows. This work is intended to provide a descriptive representation of changes in the SCG signal using an optimized measurement system. A highly specialized FPGA-based system with two isochronous accelerometers (*Kionix-KX-122, at sternum/apex*) and a reference ECG with a sample frequency of 17kHz was used. We included healthy infants and children between 0 and 14 years, with a focus on babies (*n = 12, w = 6, m = 6, 4 children under one year*). In contrast to adult measurements, working with children is demanding in many ways (e.g. movement artifacts). First, the SCG and ECG data were processed by filter mechanisms (*Butterworth 3rd order [0.25Hz, 85Hz]*) and annotated by peak-detection based on patter-analysis. With the annotated data, a detailed examination of the established SCG features with regard to absolute and relative amplitudes and time intervals was realized. Through this analysis it is possible to make initial comparisons of the child groups to adult data. The infant's SCG amplitude is up to five times smaller, but the actual signal morphology is equal. Established physiological processes of the child's heart can also be identified (e.g. high pulse-rate-variability). This work is a prelude to a further collection and should lead to an open-data database that includes data a wide range of ages as well as various pathologies.



Visualization of SCG feature differences during one measurement