Abstract:

Introduction: Researchers at MIT developed Eulerian Video Magnification (EVM), a technique that uses temporal and spatial filtering to amplify subtle changes in video data. EVM may provide a novel method to visualize low-frequency changes in human physiological data. This study aims to identify physiological oscillations such as heart rate, respiration rate, and oscillations in blood flow velocity in the microcirculation.

Background:

We hypothesize that Eulerian Video Magnification can be used to measure physiological oscillations, such as heart rate, respiration rate, oscillations in the microcirculation, and the Cranial Rhythmic Impulse (CRI).

Methods:

Human Studies: IRB approval was obtained and subjects recruited to record baseline physiological data (20min), palpate and measure the CRI (10min), apply Cranial Osteopathic Manipulation (10-20min), and assess recovery (20min). The procedure was video recorded under high definition (1080p).

Eulerian Video Magnification (EVM):

MIT and Video Magnification of the MIT developed a program that uses temporal and spatial filtering to exaggerate small color fluctuations. This magnification technique reveals imperceptible movement: Processing parameters utilized for this study were: Gaussian Pyramid (level 4), magnitude filter (500%), chrominance attenuation (1), and low and high frequency cutoff values (1-100 cycle/min).

Quantification of Oscillations in EVM Videos:

The Cranial Bowl

Physiological Data and Palpated Cranial Motion:

EVM Measures HR and Microcirculation Frequencies

Summary and Conclusion:

Heart rate, respiration rate, and oscillations in the microcirculation can be measured from a video recording using Eulerian Video Magnification (EVM). With a resolution of 0.5mm, EVM could not detect the Cranial Rhythmic Impulse. Higher resolution software and instrumentation are currently under investigation.

References:


3. Visualization of Human Oscillations: EVM frequency data was tightly correlated to ECG measures of heart rate (r² = 0.998, P < 0.001) as well as the oscillation in blood flow velocity in the microcirculation (r² = 0.820, P < 0.001). These data suggest a video recording can be used and magnified to measure physiological data.

4. Cranial Rhythmic Impulse (CRI)

5. Demonstration of Cranial Osteopathy using the skull is normal, the body parts are not assessed simultaneously, and the cranial palpation is performed in a specific sequence.


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