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Comparison of Developed Statokinesigram and Marker Data Signals by Model Approach

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Abstract : Background: Based on statokinezigram, the human balance control is often studied. Approach to human postural reaction analysis is based on a combination of stabilometry output signal with retroreflective marker data signal processing, analysis, and understanding, in this study. The study shows another original application of Method of Developed Statokinesigram Trajectory (MDST), too. Methods: In this study, the participants maintained quiet bipedal standing for 10 s on stabilometry platform. Consequently, bilateral vibration stimuli to Achilles tendons in 20 s interval was applied. Vibration stimuli caused that human postural system took the new pseudo-steady state. Vibration frequencies were 20, 60 and 80 Hz. Participant's body segments - head, shoulders, hips, knees, ankles and little fingers were marked by 12 retroreflective markers. Markers positions were scanned by six cameras system BTS SMART DX. Registration of their postural reaction lasted 60 s. Sampling frequency was 100 Hz. For measured data processing were used Method of Developed Statokinesigram Trajectory. Regression analysis of developed statokinesigram trajectory (DST) data and retroreflective marker developed trajectory (DMT) data were used to find out which marker trajectories most correlate with stabilometry platform output signals. Scaling coefficients (λ) between DST and DMT by linear regression analysis were evaluated, too. Results: Scaling coefficients for marker trajectories were identified for all body segments. Head markers trajectories reached maximal value and ankle markers trajectories had a minimal value of scaling coefficient. Hips, knees and ankles markers were approximately symmetrical in the meaning of scaling coefficient. Notable differences of scaling coefficient were detected in head and shoulders markers trajectories which were not symmetrical. The model of postural system behavior was identified by MDST. Conclusion: Value of scaling factor identifies which body segment is predisposed to postural instability. Hypothetically, if statokinesigram represents overall human postural system response to vibration stimuli, then markers data represented particular postural responses. It can be assumed that cumulative sum of particular marker postural responses is equal to statokinesigram.

Keywords : center of pressure (CoP), method of developed statokinesigram trajectory (MDST), model of postural system behavior, retroreflective marker data
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