Measuring joint kinematics of treadmill walking and running: Comparison between an inertial sensor based system and a camera-based system

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Inertial sensor systems are becoming increasingly popular for gait analysis because their use is simple and time efficient. This study aimed to compare joint kinematics measured by the inertial sensor system RehaGaitő with those of an optoelectronic system (Viconő) for treadmill walking and running. Additionally, the test re-test repeatability of kinematic waveforms and discrete parameters for the RehaGaitő was investigated. Twenty healthy runners participated in this study. Inertial sensors and reflective markers (PlugIn Gait) were attached according to respective guidelines. The two systems were started manually at the same time. Twenty consecutive strides for walking and running were recorded and each software calculated sagittal plane ankle, knee and hip kinematics. Measurements were repeated after 20min. Ensemble means were analyzed calculating coefficients of multiple correlation for waveforms and root mean square errors (RMSE) for waveforms and discrete parameters. After correcting the offset between waveforms, the two systems/models showed good agreement with coefficients of multiple correlation above 0.950 for walking and running. RMSE of the waveforms were below 5ř for walking and below 8ř for running. RMSE for ranges of motion were between 4ř and 9ř for walking and running. Repeatability analysis of waveforms showed very good to excellent coefficients of multiple correlation (>0.937) and RMSE of 3ř for walking and 3-7ř for running. These results indicate that in healthy subjects sagittal plane joint kinematics measured with the RehaGaitő are comparable to those using a Viconő system/model and that the measured kinematics have a good repeatability, especially for walking.
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