Methods: Seven healthy adults wearing skin markers on the medial and lateral femoral epicondyles (MFC and LFC), thigh (THIL, THIC, THIM), tibial tuberosity (TT), fibular head (FIB), shank (SHA), and medial and lateral malleoli (MA) performed cycling movement under simultaneous surveillance of a motion capture system and a fluoroscopy system. They also received a CT scan so that their femoral and tibial bone poses could be obtained using a fluoroscopy-to-CT registration method. The STA of the skin markers were then calculated as the marker movement relative to the underlying bone.

Results and Discussion: Considerable STA's were found during cycling exercises with greater STA on the thigh. MFC and LFC were displaced posteriorly from their true positions with knee flexion, and moved anteriorly with knee extension. THIC had greater STA among the technical markers on the thigh and moved mainly along the proximal/distal direction. TT moved within a small range throughout the cycling movement, while FIB moved mainly along the proximal/distal direction. The STA around the knee joint during the cycling movement were quantified for the first time in the literature, which will be helpful for developing guidelines for using skin markers and STA-compensation methods.

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Compensation of soft tissue artifacts on the calculated angles and moments at the knee during cycling using global optimization method

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Introduction: Soft tissue artifacts (STA) are a major source of errors in human motion analysis, affecting the calculated joint angles and moments. The Global Optimization Method (GOM) is effective in compensating STA during gait but its performance for activities involving large range of motion such as cycling has not been reported, mainly owing to the difficulty in obtaining accurate skeletal motion non-invasively. This study evaluated the GOM using the skeletal motions of the knee measured by a 3D fluoroscopy technique during cycling.

Method: Five young adults wearing 14 skin markers on the right lower limb performed cycling exercises on an ergometer while the pedal reaction forces were measured with an instrumented pedal and the trajectories by a motion capture system. The skeletal motions of the right knee were measured using a CT-to-biplane fluoroscopy registration technique and then taken as the gold standard. A 3-link model composed of the pelvis, thigh and shank was used to calculate the angles and moments at the knee from the skin markers, without considering STA and with GOM to compensate for STA. The root-mean-squared errors (RMSE) of the calculated variables were then obtained with respect to the gold standard.

Results & Discussion: The RMSE's of the angles in the sagittal, transverse and frontal planes using GOM were 2.9, 3.8 and 9.3 degrees, respectively, compared to 9.1, 7.8 and 10.8 degrees without considering STA. The corresponding values for joint moments were 1.5, 0.6 and 2.3 Nm for GOM, and 2.4, 1.1 and 3.3 Nm without considering STA. The results showed that the GOM was effective in compensating the STA of the markers for the calculation of the angles and moments at the knee during cycling movement, which will be useful for future study of knee biomechanics during cycling using skin marker-based motion analysis.

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Chaotic analysis of epileptic EEG signals

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Electroencephalogram (EEG) is the recording of the electrical activity of the brain. One of the major fields of application of this relatively cheap and non-invasive diagnostic technique is epilepsy, which affects almost 1% of the world's population. Automatic seizure detection is very important in clinical practice and has to be achieved by analyzing the EEG signals. Inter-ictal spikes and sharp waves in human EEG are characteristic signatures of epilepsy. These potentials originate as a result of synchronous, pathological discharge of many neurons. The reliable detection of such potentials has been the long standing problem in EEG analysis, especially after long-term monitoring became common in investigation of epileptic patients. In this paper, a comprehensive chaotic analysis of the normal, ictal and inter-ictal segments in EEG signals is studied using nonlinear dynamical parameters such as correlation dimension, fractal dimension exponent and entropies. These measures show distinct difference for normal, ictal and inter-ictal segments in the EEG recordings. The results are further supported by ANOVA test which gives a p-value of less than 0.01 with 95% confidence. The