A LONGITUDINAL STUDY OF THE KINEMATICS OF RUNNING IN CHILDREN

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Seven boys and five girls were filmed during a period of five years. The running action of these children was filmed starting when they were 7 years old. The camera speed was operated at 80 frames per second. The coordinates of the markers located at the main anatomical joints were computed and stored on magnetic device. Through the SPSS-ANOVA, it was possible to determine the main sources of variance both for general (i.e. height, weight, velocity of the center of gravity, stride length, etc.) and specific variables (temporal, spatial and kinematic data for each joint). The main sources of variance were found to be age, sex, and the motor behaviour of right and left limbs. Various typologies of variables were finally identified: those with constant values in the years and those showing a continuous evolutive trend. The differences between sexes and those between the right and left part of the body were finally examined and their practical implications discussed.

KINEMATICS OF THE LOWER LIMB JOINTS DURING GAIT

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System of motion analysis give the spatial trajectories of markers fixed upon a moving subject with a good accuracy. But this accuracy becomes illusive if one intends to accede to the articular motions, because of the slipping of the skin versus muscular tissues, and because of the moving of these muscular tissue versus the underlying bones. In this paper, a method is proposed to obtain internal kinematics, from external marker trajectories. Three markers define each moving segment. The slipping of the skin appears in relative motions between the three markers fixed on the same segment. The triangle formed by these markers is solidified, respecting statistical criteria, to eliminate these interferences. The trajectory of each solidified marker substitutes for the trajectory of the real marker fixed on the segment. So the new triangle associated with each moving segment behaves as if it was rigidly fixed on the underlying muscular tissues. The moving of the muscular tissues versus the underlying bones is considered as a disturbance. The disturbance is indirectly identified. For this, two hypotheses are assumed: - The internal motion of each joint (hip and knee) is a rotation around a center. This rotation center can migrate, during the motion, inside a predefined area. - The angular variation of the skeleton are closely related to those describing the solidified segments motion. These techniques have been applied on a restricted number of cases to judge method feasibility.

THREE-DIMENSIONAL MUSCLE FORCE PREDICTION DURING GAIT

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One of the problems in modelling musculo-skeletal systems is the dimensional size of the muscular subsystem. This dimensional size can be decreased, either by neglecting specific muscle behaviour or by reducing the number of planes of motion. However, these assumptions will strongly affect the outcome of predicted muscle forces and activations. Both reduction techniques are used and compared with each other. Including the muscle dynamics, the calculated muscle forces are more smoothed and are active over a longer period of time, as shown by the increase of the mechanical work. This increase is caused by more synergistic and antagonistic muscle actions. While increasing the number of motion planes, the total amount of mechanical work by the muscles does not significantly change. However, the total amount of metabolic energy consumption does increase.