BIOMECHANICAL FACTORS AFFECTING ACCURACY IN PISTOL SHOOTING

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The research was designed to investigate which of selected biomechanical factors most influenced accuracy in elite calibre pistol shooting. The 16 subjects participating in the study were elite shooters and members of the Australian Pistol shooting squad. The biomechanical parameters examined included: Body Sway, Pistol Movement, Changes in Pistol Alignment, Mean Grip Pressure, Changes in Grip Pressure and Sighting Time. A Walther CO_2 air pistol was chosen to be used in the study and the parameters investigated were examined in the period one second prior to the shot being fired, with the exception of Sighting Time. The criterion measure was the displacement of the Fall of Shot from the centre of the target. The research also examined whether movement of the Aim Point of the sights on the target was related to the criterion measure, the theory proposed by shooting coaches. Movement or change in a parameter was evaluated by the excursion or total distance travelled over the one second time period. Correlation and stepwise regression statistical analyses were utilised to identify which of the parameters most influenced accuracy. The investigation disclosed that body sway followed by pistol movement most influenced accuracy (Mult.R=0.73 p=0.01 n=16). Body Sway influenced the vertical fall of shot (r=0.63 p=.01 n=15) whereas Pistol Movement influenced the horizontal (r=0.61 p=0.01 n=16). Sighting time was also highly negatively correlated with the criterion variable (r=-0.56 p=0.01 n=16). Although there was a significant relationship between the Fall of Shot and Aim Point Movement, this relationship was not strong (r=0.20 p=0.01 n=271).

KINEMATIC ANALYSIS OF WHEELCHAIR PROPULSION FOR THREE SPEEDS OF PROPULSION

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Two male paraplegics technique of propulsion was investigated at three speeds of propulsion (60, 80, and 100%). The maximal speed was determined at the beginning of the test session. To simulate wheelchair propulsion in the laboratory, the wheelchair was mounted on rollers. For each speed of propulsion, the subjects were filmed at 50 Hz with a high speed camera (Locam) for three consecutive push cycles. The digitized film coordinates were used to compute the linear and angular kinematics of the upper body, the cycle duration, and the percentage of time spent in the contact phase. The resuls showed that as the speed increased across trials (60, 80, and 100%) was found to result from a decrease in contact phase and an increase in pushing frequency. This suggested that greater speeds were brought by an increase in pushing frequency. The subjects were found to have considerable difference in the pushing styles, these being either circular or pump arm action. Variation in trunk displacement and angular momentum were observed among the subjects which may be related to the differences in neurological lesion.

MODELING AND SIMULATION OF HUMAN GAIT IN THREE DIMENSIONS WITH MULTIBOND GRAPHS.

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Multibond graphs are used to derive a model and equations for the simulation of human gait. A simple model consists of seven rigid bodies. The connections between the bodies are pin joints with only rotational degrees of freedom. Floor contact is approximated as a spherical joint to a body (earth) which has zero velocity. During contact, the connection point (center of support) shifts along the foot. The resultant of torques, caused by active (muscle) forces, are applied to the bodies via the joints. For the description of the kinematics and dynamics of the system, body-fixed coordinate frames are chosen. Euler parameters are used in the calculation of coordinate transformation. Due to the kinematic constraints between the bodies, the inertias are not causally independent. From the multibond graph a set of implicit differential and algebraic equations can be derived, which can be solved with an iterative numerical technique. To solve the closed kinematical loop during the double support phase, additional implicit equations can be formulated and solved with the same numerical technique. Different models are formulated for the different phases in gait in order to deal with the discontinuity caused by the floor contact. The model can be simulated when input data (resultant torques, center of support), parameter values and data on initial condition (position and velocity) are available.