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LONG JUMP KINEMATICS OF WORD CLASS ATHLETES WITH AN INTELLECTUAL DISABILITY

Wolfgang Potthast[1,2] Steffen Willwacher[1], Ralf Müller[1] and Gert-Peter Brüggemann[2]

Institute of Sport and Sport Sciences, Karlsruhe Institute of Technology (KIT), Germany[1]
Institute of Biomechanics and Orthopaedics, German Sport University Cologne, Germany[2]

The aim of this study was to describe performance related kinematics parameters in long jump of elite athletes with an intellectual disability (ID athletes) and to compare to elite athletes without intellectual disability (non-ID athletes). The 2010 INAS athletics world indoor championships were analysed. Three high speed (100Hz) video cameras were used to observe the run up in 2D. A laser device recorded the full run up velocity. Overall jumping performance was worse in ID athletes compared to literature values of non-ID athletes. This also reflects low maximal run up and take-off velocities, a high within subject variations in the landing distance and distance of the last 3 steps to the take-off board. The take-off angles were comparable to those of non-ID athletes. Future research should relate performance related parameters to the cognitive potential of the athletes.

KEY WORDS: long jump, intellectual disability, paralympics, kinematics.

INTRODUCTION: The International Paralympic Committee (IPC) will include athletes with an intellectual disability in different track and field disciplines at the Paralympic Games 2012 in London. An athlete is eligible for participation, if his impairment has a direct negative influence on sports performance in the related discipline. Therefore the relation between performance related variables in certain disciplines and cognitive potentials of athletes has to be identified. No quantitative kinematic data is available of world class ID athletes in long jump. The purpose of this research project was to provide baseline data of performance related kinematic data of world class ID athletes in long jump.

METHODS: Data collection was done at the 2010 INAS world indoor championships in athletics. Data of thirteen athletes were included in this study. Only data from valid trials has been included in further analysis, leading to a total number of fifty trials. Three high speed cameras (Basler, 100 Hz) were used to gather two dimensional kinematic data of the run up, take off and landing. Additionally the time history of the run up velocity was analysed using a laser based device (LAVEG). In particular maximal run up velocity, take off velocity, take off angle, the distance of the last three foot contacts to the take off board, and the landing distance was calculated. Except for the velocity data all kinematic parameters were calculated using a thirteen segment total body model (feet, shanks, thighs, hands, fore arms, upper arms, head). The anatomical landmarks tip toes, heel, ankle, knee, hip, shoulder, elbow, wrist, hand, C7 and ear (figure 1) were optically identified using a commercially available software package for video analysis (Vicon Peak Motus 9.0).
The velocity parameters could be identified directly from the run up time histories. The take off angle was obtained by calculating arc tangent (vertical velocity / horizontal velocity). The landing distance was calculated by the distance between the projection of the COM on the ground and the very back part of the imprint in the sand representing the jumping distance. The distances between the take off board and the last three points of foot contact were obtained by digitizing the contact feet during ground contact (Vicon PeakMotus 9.0). The individual variation between trials of the distances was considered to be performance related.

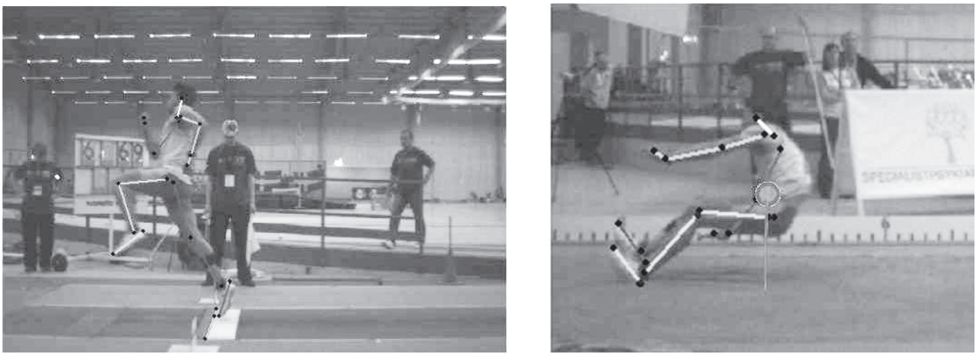

Figure 1: Representation of a valid trial. Right: Landing phase. The red line indicates the vertical projection of the centre of mass (COM) to the ground for the calculation of the landing distance. Left: Take off phase.

RESULTS: Their jumping distance of the elite ID athletes varied between about 5.5 and a maximum of 7 m. This maximal run up velocity showed a span from 8 to 10 m/s., the take off velocity from 7 to 8 m/s. Take off angles in ID athletes varied between 18° and 25°. A big variation was found in the landing distance starting a few centimetres up to 1.1 m. The distance of foot contact to the take off board varied between 0.3 to 0.2 m.

DISCUSSION: World class ID athletes show clearly reduced overall long jump performance compared to elite non-ID athletes. This outcome of the study was expected. However it is not clear, to which extent the reduced performance is related to intellectual disability of the athletes, to a lack of training quantity, or a lack of training quality. The results indicate, that some classical kinematic parameters are related to long jump performance as it is the case in non-ID athletes. The take off angle between 18° and 25° is also a typical range for non-ID athlete (Hay, 1993), while the maximal run up velocity is clearly lower than in non-ID athletes (8 to 10 m/s in ID athletes vs. 10 to 11.5 m/s in non-ID athletes), which holds also true for the take off velocity (7 to 8 m/s vs. 9 to 10 m/s) (Hay, 1993). The effect of parameters, which might be more coordination and motor control related than determined by energy and power, show even greater differences compared to non-ID athletes. The distance of foot contact to the take off board varied for ID athletes between 0.3 to 0.2 m, which is comparable to those of novice track and field athletes without intellectual disability, while elite non-ID athletes show only 0.05 to 0.1 m of variation (Berg et al., 1994; Hay et al., 1988; Lee et al., 1982). The present work does not allow relating those performance related parameters directly to cognitive potential of the athletes. It might be, that velocity related parameters are more training related rather than directly linked to intellectual disability, while parameters as landing distance and the variability of the distance between foot ground contact and the take off board might have a stronger relation to the cognitive potential. Conclusive evidence is not provided.

CONCLUSION: Future research has to focus on the relation between performance related kinematic parameters in long jump and the individual intellectual disability of the athletes.

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