

Changes of movement patterns and hurdle performance following traditional and differential hurdle training

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Introduction

To improve technical skills in sports it is often recommended to repeat the same movement over and over again. Such learning strategies assume implicitly that generalized prototypes exist and that these prototypes can be achieved by copying many times. Strong indications for the individuality of movement behaviour (Schöllhorn 1999) and a low probability for the repetition of two identical movements (Hatze 1986) lead to question these assumptions. Based on the coordination dynamics approach the concept of differential learning tries to utilize the fluctuations in human motor behaviour to induce a self organising process to the athlete which takes advantage of individual movement and learning characteristics (Schöllhorn 2000). Therefore, the athlete is confronted during the acquisition phase with a variety of exercises which extend the whole range of possible solutions for a specific situation or task. Besides, adaptational processes are rather caused by the differences between the exercises than by the numbers of repetitions. Evaluating the differential approach in sprinting (Schöllhorn et al. 2001), several exercises had been used that coincide in kinematics and dynamics with selected details of the complete movement. In this study these characteristics were applied on the hurdle sprint which requires a higher level on technical skills. The purpose was to investigate effects of differential learning on hurdle sprint technique as well as on hurdle performance.

Methods

In the training experiment ten female hurdle sprinters (age: Ø13.4y) participated. Subjects were separated into two groups: Group D performed hurdle training according to the concept of differential learning, while group T performed traditional hurdle exercises (Bauersfeld/Schröter 1986). For two months, both groups trained hurdles twice a week for 45 min. All additional training contents were identically. In pre-test and post-test hurdle sprints over 3 hurdles as well as 30m sprints were performed. 3D cinematographic data of the hurdle clearance was taken by two high-speed video cameras (125 f/s). Subject's movement was described by the time courses of the main joint angles and angular velocities and a similarity measure was calculated for each trial. All trials were compared statistically for intra- and interindividual similarities by means of cluster analysis (Schöllhorn 1999). Further, a technique index was established that described the difference between hurdle sprint and sprint performance.

Results and Discussion

After two month of hurdle training, the mean hurdle index (HI) of group D decreased from .78 in pre-test to .58 in post-test. Pre-test and post-test values of group T were .66 and .64, respectively. Higher decreases as well as highest increase of HI were observed in group D. A decrease of the HI indicated a faster hurdle clearance and therefore could be stated as positive effect of training. Considering the time courses of all variables in pre-test and post-test, the trials were mainly clustered by individuals (recognition rate: 70,9%). Within the individual clusters a separation of pre-test and post-test trials could partly be stated. For the pre-test trials of group D a recognition rate of 86,7% was observed, while only 46,7% of the post-test trials were clustered by individual. Group T showed a contrary tendency: recognition rates for pre-test and post-test were 53,3% and 60,0%, respectively. For a further classification of the hurdle trials no plausible criteria could be found.

The higher decreases of HI in group D provides evidence for a high effectiveness for the differential training approach. On the other hand, subjects of both groups perform less after the training phase whereby lowest performance is located also in group D. Concerning the movement patterns during hurdle clearance, the recognition rate for the flight phase is higher than for comparable values for running (Schöllhorn 1999/ recognition rate. 50%). This might be eventually explained by the longer flight time and higher degrees of freedom during hurdle clearance. Taken into account the lower individual recognition rate for the post-test trials as well as the decrease of the HI for group D, subjects that train with the differential learning approach seem to perform better with less similar or less stable movement patterns. Whether this results from a better adaptability to different hurdle clearance conditions or describes a transition between more stable patterns can not be clarified. Overall, the differential learning approach seems to provide an alternative for effective and motivating training.

References

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