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Comparative analysis of the Diagonal Stride technique during on-snow and roller-skiing in junior cross-country skiers

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INTRODUCTION:

To investigate the similarities and differences of the Diagonal Stride (DS) technique during on-snow and roller-skiing in junior cross-country skiers by three-dimensional video analysis. The results of this study provide a theoretical basis for the design of DS technique training and supplementary training for junior athletes on land.

METHODS:

Six junior cross-country skiers participated in the experiment. The kinematic data of the DS technique on snow and land were obtained by three-dimensional video analysis. Two cameras were placed on the left and right sides of the test ramp. The Angle between the main optical axis is about 80°, the shooting frequency is 60fps, and the shutter speed is 1/500s. Athletes techniques were obtained using automatic recognition techniques and Direct Linear Transformation (DLT) methods. The coefficient of multiple correlations (CMCs) and one-dimensional statistical parametric mapping (SPM1d) were used to evaluate the similarity and difference in angle-time curves for each stage of the DS technique for on-snow and roller-skiing. Paired sample T-test was used to compare the cycle characteristics, range of motion at each stage, and the angle at each moment of DS technique between on-snow and roller-skiing.

RESULTS:

No significant difference in roller-skiing cycle characteristics compared to on-snow in DS technique. The hip flexion and extension angles are highly similar and the body anteversion angle, trunk anteversion angle, calf anteversion angle, and the vertical movement range of the center of the mass showed moderate similarity in the landing stage and the swing stage; The adduction and abduction angle of the hip joint showed low similarity in the swing stage, the body anteversion angle and calf anteversion angle are smaller on roller-skiing and the anteversion angle is smaller on roller taking off. The flexion and extension angle of the shoulder joint, the adduction angle of the shoulder joint, the flexion and extension angle of the elbow joint, the angle of pole-ground, and the vertical movement range of the center of mass show high similarity in the poles-support stage and the back-swing stage; The body anteversion angle in the poles-support stage and the trunk anteversion angle in the back-swinging stage are moderately similar; The range of flexion and extension of the shoulder joint is small in the back-swinging stage, and the body anteversion angle and trunk anteversion angle are small at poles landing and taking off.

CONCLUSION:

Higher similarity of upper limb movements, the moderate similarity of lower limb movements between on-snow and roller-skiing with DS technique, and the movement range of the DS technique on land are small. Junior athletes should imitate fast kick in the kick zone of the ski when training DS technique on the roller, and increase the explosive power of the lower extremity, especially the explosive power of plantarflexion, as well as upper extremity extensor strength.

Topic: Biomechanics

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