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A longitudinal study of three-dimensional pelvic behavior in maximal sprint running.

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INTRODUCTION:

Sprinting speed is determined by step frequency and step length, and there is an inverse relationship between step frequency and step length. It is important to increase step frequency while maintaining the large step length for achieving high sprinting speed. Improvement in the recovery of leg motion during sprinting results in an improvement in step frequency, and this motion is associated with the pelvis rotating to the free leg side (Sado et al., 2017). Sado et al. (2017) found that the pelvis rotates to the free leg side, which is associated with the greater free leg side lumbosacral joint torsional torque, assisting in the recovery of leg motion of the stance leg. Thus, it seems reasonable that the free leg side lumbosacral joint torsional torque during sprinting may have an important function in terms of achieving high sprinting speed. However, these findings were investigated cross-sectional in terms of the relationship between variables and differences in competition levels, and no longitudinal study has been reported to investigate changes in the factors influencing step frequency and step length with increasing sprinting speed. Therefore, the purpose of this study was conducted to investigate the longitudinal change in the kinematics and kinetics of the pelvis using data with the increasing sprinting speed.

METHODS:

Nine male sprinters performed a 60 m sprint from a crouching start at maximal effort, which was conducted at twice in a 1-year period, and the data from the 2 tests were analyzed. Each participant was attached with 47 retro-reflective markers to their trunk and limbs for motion capture. A 26-camera motion capture system at 250 Hz was used to record the three-dimensional coordinates of the position of each reflective marker. The ground reaction force at 1000 Hz was recorded using a force platform, and the values were synchronized with the motion data. After normality was confirmed, Student's paired t-test was applied to compare the statistical significance at $p < 0.05$.

RESULTS:

During the test 2, the sprinting speed and step frequency were significantly higher compared to the test 1. The kinetics pattern of pelvic rotation indicated that the lumbosacral joint torsional torque toward the stance leg side was greater until the middle of the stance phase and that the lumbosacral joint torsion torque toward the free leg side was greater. The integrated contributory component of the lumbosacral joint torsion angular impulse during the total and stance phase were significantly greater in the test 2 than in the test 1.

CONCLUSION:

It is important for achieving high sprinting speed to exert free leg side lumbosacral joint torsional torque from the middle of the stance phase to toe-off, resulting in the faster recovery leg motion and increasing step frequency.

References

Sado, N., Yoshioka, S., and Fukashiro, S. (2017). The three-dimensional kinetic behaviour of the pelvic rotation in maximal sprint running. *Sports Biomechanics*, 16: 258-271.

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