Calculation of Cycling Mechanics Symmetry in Competitive Cyclists

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Cycling mechanics symmetry has been extensively studied given the importance to injury prevention and performance. The definition of symmetry, however, varies within the literature and limits valid comparisons. **PURPOSE:** To determine and compare cycling mechanics symmetry within and between three calculated methods. METHODS: Thirty one competitive cyclists (Age: 34.5 ± 9.8 years; Height: 1.77 ± 0.11 m; Mass: 76.3 ± 11.1 kg) cycled untethered on a high speed treadmill at 25.8 km \cdot hr⁻¹ and a 2% incline. Kinematic and pedal force data were collected with a 3D motion analysis system and custom designed pedals. Total sagittal and frontal plane motion of the hip and knee, sagittal plane ankle motion, maximum power and recovery phase effective forces were calculated. The dependent variables were analyzed for Right – Left (RL), Dominant – Non-Dominant (DN), and Larger Total Kinematic Excursion – Smaller Total Kinematic Excursion (GP) methods. A symmetry score was calculated for each dependent variable as the within-method percent difference and compared between the three methods. A priori statistical significance was set at p < 0.05 for all analyses. **RESULTS:** Frontal plane hip (R: $14.2 \pm 3.8^{\circ}$, L: $16.1 \pm 5.0^{\circ}$) and knee (R: $19.8 \pm 9.6^{\circ}$, L: $25.6 \pm 13.8^{\circ}$) motion were asymmetrical for the RL comparisons. Power (D: 353.0 ± 65.4 N, N: 311.3 ± 62.5 N) and recovery (D: 44.6 ± 18.3 N, N: 34.6 ± 13.8 N) phase effective forces were asymmetrical for the DN comparisons. Frontal plane hip (G: $16.3 \pm 4.8^{\circ}$, P: $14.0 \pm 4.0^{\circ}$) and knee (G: $26.6 \pm$ 12.7°, P: 18.8 \pm 10.3°) motion and sagittal plane ankle motion (G: 36.1 \pm 12.5°, P: 27.4 \pm 9.6°) were asymmetrical for the GP comparisons. RL – GP symmetry scores varied for frontal plane hip (RL: -16.4 \pm 30.6%, GP: 10.5 \pm 22.6%) and knee (RL: -54.0 \pm 107.6%, GP: 17.9 \pm 47.0%) motion and sagittal plane ankle motion (RL: -8.3 \pm 44.2%, GP: 20.9 \pm 22.1%). DN – GP symmetry scores varied for frontal plane hip motion (DN: $-11.6 \pm 33.7\%$, GP: $10.5 \pm 22.6\%$), sagittal plane ankle motion (DN: -4.2 \pm 42.2%, GP: 20.9 \pm 22.1%), and power phase effective force (DN: $11.5 \pm 8.2\%$, GP: $-2.8 \pm 16.6\%$). RL – DN symmetry scores varied for power phase effective force (RL: $-1.8 \pm 16.6\%$, DN: $11.5 \pm 8.2\%$). **CONCLUSIONS:** Identification of cycling mechanics symmetry is method-specific and a consensus is necessary with regard to defining symmetry for valid data comparisons.