A PROTOTYPE FOR SIMULTANEOUS ARM AND LEG CRANK BICYCLING: A CASE STUDY

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The purpose of this study was to examine selected physiological and biomechanical parameters of performance while riding a prototype for simultaneous arm and leg crank bicycling. A well trained male cyclist aged 38 yrs with a body mass of 70.7 kg, 11.2% fat, and a height of 180.3 cm served as the subject. For comparison, two graded rides to exhaustion were performed, one on a standard leg crank bike and another with the arm/leg crank bike. Rides were performed on a treadmill at a speed of 15 mph beginning at 0 grade and increased by 2% every 4 min until exhaustion. Video analysis was performed over 3 crank revolutions, across all workloads (% grade) with 2- dimensional spatial modelling to quantify biomechanical parameters. At maximum, both RER's were 1.11, HR's were 186 and 185 bpm, and VO_2's were 64.2 and 58.2 ml*kg* min^{-2} for leg crank bike and arm/leg crank bike, respectively. The subject rode 2 min longer and performed 31% more work with the arm/leg crank bike. The subject on the arm/leg crank bike had a 3° greater trunk-to-thigh angle than on the leg crank bike. Likewise, the hip position, relative to the leg crank, was 5.3 cm further forward on the arm/leg crank bike. The internal knee angles were also slightly larger (3°). As exercise intensity increased the trunk became more active in both types of cycling, with greater range and magnitude of the trunk lean in the arm/leg crank bike (63.6°) compared to the leg crank bike (59.2°). Similarly, during arm/leg crank bike shoulder retraction increased through a large displacement, ranging from 9.0° at 0 grade to 17.2° at 8% grade. Linear displacements for the shoulder ranged from 14 cm horizontally to 16 cm vertically and 2.9 cm horizontally to 3.2 cm vertically in the arm/leg crank bike and leg crank bike, respectively. In general, the arm/leg crank bike mechanics appear to produce more continuous propulsive forces throughout the ride. This may compliment some of the less productive positions characteristic of leg cranking alone. Based on these preliminary data further research and development appear to be warranted.