The effect of handlebar grip in seated and non-seated postures on muscle activity and joint moments during sprint cycling

Research Proposal

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Cycle ergometry has traditionally been implemented as a method of isolating and assessing lower body power output (Baker et al., 2001). Test parameters typically involve an all-out pedalling effort for a duration of 6, 10, 20, or 30 seconds, against a standardised resistance of 75 grams per kilogram of bodyweight, on a friction loaded cycle ergometer (Baker and Davies, 2009; Aylon et al., 1974; Dotan et al., 1983; Inbar et al., 1996). However, current evidence is indicative of a significant contribution to Peak Power Output (PPO) by mechanical work performed by the upper body through the handlebars. Consequentially, the validity of maximal cycling ergometry as a measure of lower-body power and performance is jeopardised due to limited knowledge on the magnitude and nature of apparent upper body contributions to peak power output. Upper body-based force production on the handlebars during cycling boasts the potential advantage of utilising the contribution of the centre of mass of the rider, as well as provide a foundation for greater activation and force production from the lower body musculature, which may in-turn facilitate a greater transfer of force to the pedal. Baker and colleagues (2001) measured the power output of a group of cyclists using two protocols: ‘with’ and ‘without’ gripping the handlebar. Their results revealed a significant increase of 9% in peak power output when cyclists gripped the bars compared to when they didn’t (886 ± 124W and 815 ± 151W, respectively). The authors suggested that gripping the handlebars resulted in a transfer of force that stabilised the centre of mass of the rider, which enabled a greater force to be applied to the crank. In the same study, pilot electromyographic data showed that activity from the forearm muscles when gripping the handlebars was similar to, if not greater than, the activity recorded from these same muscles during a maximum isometric voluntary gripping contraction, indicating a high level of muscle activity during high intensity cycling. A similar observation was reported by Doré et al. (2006) who found reduced power output when comparing the no grip to grip conditions in adolescent male and female cyclists (521 ± 65 versus 604 ± 63 and 303 ± 80 versus 344 ± 103, respectively).

The aim of this study was to examine the effect of grip versus no-grip on muscle activity (phase and amplitude), lower limb joint moments and peak power output in two cycling postures (seated and non-seated) that are commonly used when sprinting for brief periods.

We hypothesised that the grip compared to no-grip condition will result in an increase in muscle activity in the extensor muscles of the lower limbs that will result in an increases in their respective joint moments, thereby resulting in greater power production at the crank in both the seated and non-seated cycling postures. We also hypothesise greater levels of muscle activity in the grip condition for several upper body muscles .