EFFECT OF AN EXPERIMENTAL PEDAL ON MAXIMAL POWER OUTPUT AND PEDALLING TECHNIQUE IN TRAINED CYCLISTS

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INTRODUCTION: The aim of the present study is to evaluate the effect of an experimental pedal system (EP) on maximal isokinetic power generation and pedalling technique during cycling of well trained cyclists. Compared to habitual pedals (HP), in EP the foot contact area with respect to the pedal axis was located more inferior and anterior, which affects the distance between the crank axis and the point of force application (Functional crankarm length, F_{cal}) during the pedalling cycle. Since Martin (2001) showed enhanced propulsive torque in the downstroke of the pedalling cycle with longer crankarm length, we hypothesized EP to improve maximal isokinetic power output (P) and that the improvement is related to F_{cal}.

METHOD: Maximal isokinetic power output was evaluated on a self developed isokinetic ergometer, instrumented with a torque transducer, allowing subjects to use their own bicycle. Sixteen well trained cyclists [age (mean ± SEM): 25±1yr; height: 1.81±0.01m; body mass: 72.8±1.7kg; training kilometers per year: 9460±1390 km/yr; cycling experience: 5.7±0.7yr] performed a set of intermittent sprint tests with HP and, on another day and in random order, with EP. Each set consisted of five randomized, short (5s) maximal isokinetic sprints at fixed cadences of 40, 60, 80, 100 and 120 rpm interspersed by 2 min recovery intervals at 100 watt at 80 rpm. Thereby, cranktorque (T) was digitized at a frequency of 1 kHz. Power (P) was calculated from T and crank angle values and was evaluated using a 2x5 [pedal system (HP, EP), cadence (40, 60, 80, 100, 120), $p<0.05$] ANOVA for repeated measurements. Differences were identified using *post hoc* analysis.

RESULTS: At all cadences, a gain (on average 3.5%) in P was observed (HP vs EP : 509.2±18.3 vs 537.8±17.1; 794.9±29.1 vs 827.9±28.2; 968.1±31.3 vs 1003.6±33.2; 1051.1±39.0 vs 1075.9±38.5; 1036.6±37.8 vs 1054.9±39.8; at respectively 40, 60, 80, 100 and 120 rpm). Optimal sprint cadence decreased (107.2±1.7 vs 104.8±1.0) using EP. The torque gain within a pedalling cycle corresponded with the increase of F_{cal} in EP compared to HP.

DISCUSSION: The relative gain in power output decreased with increasing cadence. Wether EP is less useful at the commonly used higher cadences in submaximal cycling remains a debatable question that can not be clarified by this study.

CONCLUSION: Sprint power output of well trained cyclists increased using EP due to an increase in F_{cal}. More research is needed to refine the experimental pedal design and to evaluate its qualities for training and racing in all types of cycling events including efforts of longer duration

REFERENCES:

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