BOOK OF ABSTRACTS **Open Access**

Influence of positional biomechanics on gross efficiency within cycling

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Abstract

Background: Research has found that manipulation of a single variable of bike-fit such as saddle height can improve performance within cycling efficiency (Peveler, & Green., 2010: Journal of Strength and Conditioning Research, 25(3), 1–5) and reduce aerodynamic drag (Garcia-Lopez et al., 2008: Journal of Sports Science, 26, 277-286). However, limited research exists concerning the biomechanical influences on gross efficiency, a key factor in endurance performance (Ettema, & Lorås., 2009: European journal of applied physiology, 106(1)1–14). In addition, many private companies offer numerous bike-fitting systems yet fail to provide consistent findings. The present study proposed to build on previous research by using a dynamic bike fitting system to explore how a number of biomechanical manipulations to a cyclist's position can affect performance and cycling gross efficiency.

Purpose: The main aim of the study was to investigate the effects on performance by manipulating a cyclist's bike fit in-line with normative bike fitting data. For the purpose of this study the identifiable performance improvement was gross efficiency (GE) and the system that was used to perform the bike-fit was the Retül bike-fit system. The hypothesis tested was that changing a well-trained cyclist's position in-line with normative data using a popular bike fitting system could improve performance in cycling gross efficiency.

Method: Six well-trained cyclists (mean ±s: age, 30 ±13.1 years; height, 179.9 ±5.7 cm; mass, 75.1 ±8.1 kg; $W_{max,}$ 330 ±19.1 W; $VO_{2\ max,}$ 66.1 ±10.3 $mL{\cdot}kg^{-1}{\cdot}min^{-1}$) completed one VO_{2max} test, two sub maximal tests and one Retül bike fit. Submaximal tests consisted of three randomised 8 min incremental workloads of 50%, 60% and 70% VO2max. VO_2 and VCO_2 were recorded for final 4 min. The tests measured maximal minute power (W_{max}), blood lactate, $VO_{2max,}$ VO_2, VCO_2 and GE. The data was analyzed using a Wilcoxon signed-rank test and a one tailed t-test.

Results: Significant changes were observed (p=0.037) during the post bike-fit condition within the 60% W_{max} increment (16.78% vs.17.44%; p= .037). Although non-significant, increases were apparent within the 50% W_{max} increment (16.27% vs. 16.44%; p= 0.565) and again within the 70% W_{max} workload (17.60% vs. 18.18%; p= 0.111).

Discussion: The findings of the present study show higher % increases in GE than previous studies related to changes in GE over time (2.74% in the present study vs. 1-2% (Coyle, 1995: Exerc. Sport Sci. Rev. 23, 25–63). This suggests biomechanical changes can improve performance in well-trained cyclists. Further analysis shows a possible trend within cycling experience and GE improvements within the participant group that would benefit from further investigation.

Conclusion: This study has found an increase in gross efficiency between pre and post bike-fit conditions. Specifically, one of the more noteworthy findings to emerge from this study is that at 60% W_{max} GE was significantly increased across the participant group. Although the current study is based on a small sample of participants, the findings suggest that overall the absolute % increase in GE within each incremental workload would offer performance enhancements following improvements to their bike position.

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