Effects of chainring design on 1km time trial performance over six weeks in competitive cyclists and triathletes (Poster)

Christie R O'Hara, California Polytechnic State University - San Luis Obispo

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Effects of chaining design on 1km time trial performance over six weeks in competitive cyclists and triathletes

Christiane R. O’Hara, MS; Robert D. Clark, PhD; Todd Hagopian, PhD; Karen McAughey, PhD
Department of Kinesiology, California Polytechnic State University, San Luis Obispo, CA

ABSTRACT

To examine the effects of chaining design on performance measures with competitive cyclists. Several physiological and biomechanical markers (i.e., dependent measures) were examined including heart rate, volume of oxygen consumption, volume of carbon dioxide excretion, ventilation, respiratory exchange ratio, efficiency, blood lactate, power, speed, and time.

METHODS

Subjects: 4 Male Competitive Cyclists
Instruments: Power (Watts), Heart rate (bpm), Breathing ratio, Oxygen consumption, Carbon dioxide output, Lactate

RESULTS

1-km Time Trial
- Performance time was on average 1.6 seconds (1.8%) significantly faster with Rotor Q-Rings compared to round chainrings (Figure 3).
- Power was on average 26.7 watts (6.2%) significantly greater with Rotor Q-Rings compared to round chainrings (Figure 4).

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CONCLUSIONS

Rotor Q-Rings Improve Performance
- Q-Rings provide performance advantage in 1km time trial
- 1.6x faster time, 26.7 watts more power, 0.7 kph increase in speed

Submaximal Exercise
- Significantly lower heart rate and VO2
- There was no initial increase VO2 or heart rate
- Therefore, no disruption to the coordination structure used to apply force to the pedals (i.e. disadvantage to using Q-Ring)
- A greater energy savings could be realized for endurance type cycling, followed by an all out sprint
- Performance improvements only after 1 week with Q-Rings
- No change in VO2 max (no training effect)
- After discontinued use with Rotor Q-Rings
- Overall performance in 1km time trial returned to baseline
- Heart Rate and VO2 increased

BACKGROUND

“Los Altos, Fortress” (Faster, Higher, Stronger) Olympic motto
- Athletes have sought to maximize athletic performance by increasing human speed, strength, and power through equipment modifications since the bicycle’s invention in the 1800’s
- Chainrings attempt to take advantage of the area where the most force is applied during the pedal stroke (by creating a variable drive radius), thereby providing greater momentum to the bicycle.

Protocols
- Well controlled environment, morning testing after 12-hr fast
- Food intake and training logs were tracked
- 15 minute warm-up and calibration of equipment before testing
- Graded Exercise Test
  - Start at 150 W, increase 30 W after every 3 minute stage
  - End tests at 300 W (for submaximal) or until exhaustion (maximal)
- Blood lactate concentration, HR, RPE, and complete metabolic fuel sampling were recorded each stage
- 1-km Time Trial
  - 5 minutes after graded exercise test
  - All out effort to simulate a “mid-race” or “end-of-race” sprint performance
  - Power, speed, and time recorded

Statistical Analysis
- SAS®/SAS®/SAS®/SAS® software Version 9.2 for Windows
- One-way or repeated measures ANOVA,
- Bonferroni, Holm-Sidak or Tukey

Submaximal Graded Exercise Test
- Significantly lowering absolute oxygen consumption with Q-Rings during weeks 2-4 compared to week 0 on round chainrings rings
- Significantly lower heart rate (approximately 2%) with Q-Rings
- Notably lower blood lactate concentration at higher workloads using Q-Rings, with differences reaching up to 1 mmol/L lower at 300W

ACKNOWLEDGEMENTS

Thank you to all those who have helped including:
- Cal Poly Kinesiology Department
- Dr. R.D. Clark, Dr. Hagopian, Dr. McAughey
- Research Assistants: Francesca Conticacci, Kediyam Aloni, Hillary Cracow, and Joe Batch
- All participants from the Cal Poly Wheelman and Triathlon Team

For additional information please contact
Christine O’Hara or Bob Clark
Kinesiology Department
California Polytechnic State University
cohara@calpoly.edu or rbc4clark@calpoly.edu