The validity of predicting $\dot{V}O_{2\text{max}}$ from perceptually regulated treadmill exercise.

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The validity of predicting $\dot{V}O_{2\text{max}}$ from perceptually regulated treadmill exercise.

Abstract

John Hayton

Objective: The purpose of this study was to assess the validity of predicting $\dot{V}O_{2\text{max}}$ from sub-maximal $V\dot{O}_2$ values elicited during perceptually-regulated treadmill exercise tests.

Methods: Eleven males and seven females with a mean age of 21.7 (±2.8) years completed three identical sub-maximal, perceptually-guided graded exercise tests (PGXTs) on a motorised treadmill and a final maximal graded exercise test (GXT) to establish $V_{O2\text{max}}$. Participants performed testing over a ten day period, allowing for two days rest between tests. When performing the PGXTs participants were required to produce intensities corresponding to levels 9, 11, 13 and 15 on Borg’s 6-20 ratings of perceived exertion (RPE) scale, in that order. Each RPE production level was performed for three minutes, measurements of $V\dot{O}_2$ and heart rate were measured continuously and recorded in the final 30 seconds of each level. The Bruce protocol was selected for the maximal GXT ($\dot{V}O_{2\text{maxGXT}}$). Individual linear regression relationships between RPE and $V\dot{O}_2$ for the RPE ranges of 9-15, 9-13 and 9-11 were extrapolated to both RPE$_{19}$ and RPE$_{20}$.

Results: For the RPE range 9-15 prediction accuracy improved with practice across consecutive trials reporting 50.0±10.1, 49.1±8.1, and 47.3±6.9 ml·kg$^{-1}$·min$^{-1}$ for trials 1, 2 and 3 respectively, as the actual mean $V\dot{O2}_{\text{max}}$ reported was 48.0±6.2. The third and final trial produced the best LoA between predicted and actual $V\dot{O2}_{\text{max}}$ of -0.6±7.1 ml·kg$^{-1}$·min$^{-1}$, therefore achieving a worst case scenario range of 6.5 ml·kg$^{-1}$·min$^{-1}$ below the criterion $V\dot{O2}_{\text{max}}$ score and 7.7 ml·kg$^{-1}$·min$^{-1}$ above. Consistency soundly improved between trials reporting LoA of 0.90±12.3 between trial 1 and 2, and 1.72±8.50 between 2 and 3. However, the RPE ranges 9-11 and 9-13 decreased in accuracy and consistency from consecutive trials and thus reported considerably less favourable LoA analyses. The closest predictions to actual $V\dot{O2}_{\text{max}}$ when using the 9-13 and 9-11 range were generated from the first trial, providing poor worst case scenario ranges of 18.6 – 18.9 ml·kg$^{-1}$·min$^{-1}$ and 16.9 – 32.2 ml·kg$^{-1}$·min$^{-1}$, respectively.

Conclusions: The data suggest that a sub-maximal, perceptually-guided, graded treadmill exercise protocol can provide acceptable estimates of $V\dot{O2}_{\text{max}}$ when employing a perceptual range including at least a high order RPE of 15. Estimates are further improved with practice in young, healthy individuals. The poor predictive performance when using the RPE ranges 9-11 and 9-13 were attributed to less apparent sensations of exertion.

Key words: Ratings of Perceived Exertion (RPE) · Perceptual-Regulation · $V\dot{O2}_{\text{max}}$

Production Paradigm · Exercise Test
Declaration

This work is original and has not been previously submitted in support of a Degree, qualification or other course.

Signed ......................................................

Date ............................................................
I would like to take this opportunity to thank Mike Morris for his direction and supervisory expertise.

I am also deeply grateful to all the participants who gave up their time on four separate occasions to undertake the gruelling procedures requested of them.

Special thanks are reserved for my family whose unwavering support made this whole experience possible.
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