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ORIGINAL ARTICLE

A novel incremental slide board test for speed skaters: Reliability analysis and comparison with a cycling test

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Abstract

Introduction: Exercise prescription from indices obtained from cycling or running treadmill incremental tests does not seem suitable for speed skaters. However, the specificity of laboratory skating assessments remains to be established.

Purpose: This study intended to assess the test–retest reliability of an incremental test performed on a slide board (SB), and its validity compared with a cycling protocol in order to determine aerobic performance indices in speed skaters.

Methods: Ten competitive inline speed skaters performed two incremental tests on an SB and one cycling incremental test. The intensity of SB test was determined by cadence, starting at 30 push-offs/min and increasing by three push-offs/min each minute, until volitional exhaustion. Maximal and submaximal values related to the anaerobic threshold (AT) of oxygen uptake (VO_2), pulmonary ventilation (VE), respiratory exchange (RER), heart rate (HR), rating of perceived effort (RPE), cadence (CAD), and blood lactate concentration ([Lac]max) were measured.

Results: No significant differences were found in any of the variables between test–retest on SB. High relative (ICC > 0.9) and absolute reliability (typical error of measure as $CV_{TEM} < 3.5\%$) were found for VO_2max, HRmax, [Lac]max, CADmax, VO_{2AT}, CAD_{AT}, and RPE_{AT}. In comparison to SB test, the [Lac]max was significantly higher during cycling, and the RPE_{AT} was lower. VO_2max, HRmax, CADmax, VO_{2AT} and CAD_{AT} were largely correlated between cycling and SB ($r > 0.8$).

Conclusions: The findings suggest that SB test is reliable and adequate to evaluate aerobic performance indices of speed skaters.

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Nuevo test incremental en una base de deslizamiento para patinadores velocistas: análisis de confiabilidad y comparación con un test de ciclismo

Resumen

Introducción: La prescripción de ejercicios obtenidos por medio índices de tests de ciclismo o sobre la cinta de correr, parecen no ser apropiados para patinadores. Sin embargo, la especificidad de medidas de laboratorios para patinadores debe ser establecida.

Objetivo: Evaluar la confiabilidad del test-retest de un test incremental realizado en una base de deslizamiento (BS), así como la validez del mismo comparado con un protocolo de ciclismo para determinar índices aeróbicos en el desempeño de patinadores velocistas.

Métodos: Diez patinadores velocistas *inline* ejecutaron dos tests incrementales sobre un BS y un test incremental de ciclismo. La intensidad del test sobre BS fue determinada mediante la cadencia, comenzando en 30 empujes/min y aumentando en tres empujes/min a cada minuto hasta el agotamiento volitivo. Fueron medidos valores máximos e submáximos relacionados con el umbral anaeróbico (UA) del consumo de oxígeno (VO_2), ventilación pulmonar (VP), intercambio respiratorio (IR), frecuencia cardíaca (FC), escala de percepción de esfuerzo (EPE), cadencia (CAD) y lactato sanguíneo ([Lac]max).

Resultados: No se encontraron diferencias significativas entre test–retest sobre la BS en ninguna de las variables. Se obtuvieron niveles elevados en el coeficiente intercalase (ICC > 0.9) y en la confiabilidad absoluta (error típico de medida CV_{TEM} < 3.5%) para el VO_2max, FCmax, [Lac]max, CADmax, VO_{2AT}, CAD_{AT}, and EPE_{AT}. En comparación con el test de BS, el [Lac]max fue significantemente más alto durante el test de ciclismo y la EPE_{AT} fue más baja. El VO_2max, FCmax, CADmax, VO_{2AT} and CAD_{AT} tuvieron correlación alta entre el test de ciclismo y el de BS (r > 0.8).

Conclusión: Los resultados obtenidos sugieren que el test de BS es confiable y adecuado para evaluar índices de desempeño de patinadores velocistas.

Introduction

Skating sports involve both aerobic and anaerobic energy supply.[1,2] During the start, a large amount of anaerobic energy contribution is necessary to accelerate, and then, the last lap is predominantly covered on the basis of aerobic power. Even during the last lap of a 1500 m track race the energy is supplied by greater than 90% aerobic sources.[1] This reveals the importance of aerobic fitness for professional inline or on ice speed skaters.

Aerobic fitness tests are largely used to monitoring endurance performance, and to control and prescribe training intensities during speed skating.[3] To be effective, the performance evaluations for exercise prescription must be valid, reliable and movement-specific. It is generally accepted that optimal adaptations can be obtained from training loads specifically related to the sport activity itself, due to the physiological and neuromuscular specificity.[4,5]

Exercise prescription from measurements obtained from cycling or running treadmill incremental tests does not seem suitable for speed skaters.[6,7] However, the specificity of laboratory skating evaluations remains to be established, particularly because skating activities are difficult to simulate in the laboratory.[3] Since the development of the skating treadmill in 1993, there has been little research on the skating treadmill's validity to elicit a VO_2max, or determining what type of protocol to use for evaluating physiological indices.[8] Also, skating treadmills are very expensive and challenging to be used by coaches to optimise the training

programmes of athletes through periodic laboratory evaluation.

Given the importance of aerobic parameter assessment to monitoring inline or on-ice speed skaters, it is valuable to develop an appropriate test for these athletes. In this sense, the SB has been widely used as an off-ice training modality by speed skaters, since it seems to mimic the speed skating gesture. However, to the best of our knowledge, there are no studies attempting to validate a specific test to evaluate aerobic indices of speed skaters or using a slide board (SB) as ergometer. The developing of an incremental test using the SB may allow for a simple and low cost sport-specific evaluation of speed skaters.

Thus, the purpose of this study was twofold: (1) to assess the test–retest reliability of a short incremental test performed on SB; (2) to compare maximal and submaximal aerobic indices obtained from cycling and SB skating incremental tests.

Material and methods

Participants

Eight male and two female competitive inline speed skaters voluntarily participated in the study. They all had SB training experience and have skating for at least three years. The mean age was 30.6 ± 6 years. The mean body mass, percentage of body fat and height were respectively, 71.4 ± 11 kg,