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Exercise intolerance after mild traumatic brain injury: the role of heart rate, symptom provocation and rehabilitation

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Abstract

Introduction

Every year approximately 2.8 million people are diagnosed with a mild traumatic brain injury (mTBI) and often report exercise intolerance. Currently intolerance is categorized into a binary pass/fail, but we might be missing valuable information such as max heart rate (HRmax) achieved and symptom provocation during exercise. Changes to percent HRmax and symptom provocation may provide insight on recovery.

Purpose

To explore HRmax and symptom changes in people classified as exercise tolerant versus intolerant before and after multimodal rehabilitation.

Methods

Sixty-eight mTBI participants (55 females, mean \pm SD: age 35.0 \pm 11.8 yrs, 72.9 \pm 30.8 days since injury) were included. Exercise tolerance was assessed with the Buffalo Concussion Treadmill Test (BCTT) pre/post 6-week rehabilitation. Participants passed the BCTT if they achieved 85% of their age predicted HRmax (220-age) or Borg Rate of Perceived Exertion (\geq 17/20). Participants failed the BCTT if they had increased headache and dizziness symptoms (\geq 3/10).

Results

Forty-six percent were classified as exercise tolerant: avgHRmax pre-rehabilitation was 81% and symptom average was 4.1/10. After rehabilitation, this group improved 3.6% in avgHRmax (84%) and had 50% improvement in symptoms (1.7/10). Of the exercise intolerant group (n=37), 17 became exercise tolerant after rehabilitation: avgHRmax pre-rehabilitation was 71% and symptom average was 7.7/10 and improved 13% in avgHRmax (82%) and 74% reduction in symptoms (2.0/10). Twenty

participants remained exercise intolerant: avgHRmax pre-rehabilitation was 64% and symptom average was 8.6/10 and improved 14% in avgHRmax (74%) and had a 42% reduction in symptoms (5.0/10).

Conclusions

HRmax and symptoms improved with rehabilitation despite binary classification of exercise tolerance before and after rehabilitation. A greater change in average symptom score compared to percent of HRmax suggests symptom management may be a better target for intervention to improve exercise tolerance. Further analysis on physiological and affective mechanisms of symptom provocation is needed to facilitate new rehabilitation strategies.