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Original studies

Thoracolumbar spinal manipulation and the immediate impact on exercise performance

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Abstract

Objective: The purpose of this study was to determine if thoracolumbar chiropractic manipulative therapy (CMT) had an immediate impact on exercise performance by measuring blood lactate concentration, exercise heart rate, and rating of perceived exertion during a treadmill-based graded exercise test (GXT).

Methods: Ten healthy, asymptomatic male and 10 female college students (age = 27.5 ± 3.7 years, height = 1.68 ± 0.09 m, body mass = 71.3 ± 11.6 kg: mean ± SD) were equally randomized into an AB:BA crossover study design. Ten participants were in the AB group, and 10 were in the BA group. The study involved 1 week of rest in between each of the 2 conditions: A (prone Diversified T12-L1 CMT) vs B (no CMT). Participants engaged in a treadmill GXT 5 minutes after each week's condition (A or B). Outcome measures were blood lactate concentration, exercise heart rate, and rating of perceived exertion monitored at the conclusion of each 3-minute stage of the GXT. The exercise test continued until the participant achieved greater than 8 mmol/L blood lactate, which correlates with maximal to near-maximal exercise effort. A dependent-samples *t* test was used to make comparisons between A and B conditions related to exercise performance.

Results: No statistically significant difference was shown among any exercise response dependent variables in this study.

Conclusions: The results of this research preliminarily suggest that CMT to T12-L1 does not immediately impact exercise performance during a treadmill-based GXT using healthy college students.

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Introduction

Many chiropractic doctors work with amateur and professional athletes on a daily basis. The use of chiropractic in sports is gaining increasing respect following the inclusion of chiropractic doctors in the 2007 World Ice Hockey championships,[1] 2010 Olympic Winter games,[2] and other sporting events. There is an abundance of non–peer-reviewed chiropractic literature purporting that chiropractic can improve exercise performance.[3-5] The true impact chiropractic manipulative therapy (CMT) has on exercise performance, however, has been poorly studied and warrants further review.[6-13] Some researchers have argued that most studies demonstrating that chiropractic improves exercise performance have been of questionable quality.[14] As a result, this field warrants further review. Monitoring performance on an exercise test following CMT is one method to chronicle improvement in function. Blood lactate concentration (BLC), exercise heart rate, and rating of perceived exertion (RPE) are a few of many methods to monitor exercise performance during exercise testing that would be capable of testing the impact of CMT.[15-19]

Blood lactate is an important biomarker of cardiovascular exercise intensity. Skeletal muscle cells generate hydrogen and lactate ions that lower muscle pH during physically challenging exercise.[20-22] Muscle saturation with hydrogen ions in many studies has been associated with a reduced ability to generate force and is one of several processes that contribute to peripheral fatigue.[23,24] The impact lactate ion accumulation has within muscle is less clear. As lactate ions build up in muscle cells, lactate will start to spill into the bloodstream.[25-27] Lactate accumulation in the blood can be an indicator of exercise intensity because, at rest, it is tightly regulated near 1 ± 1 mmol/L.[28-48] Interestingly, during exercise, the lactate that accumulates in the blood begins to cross over into the cerebrospinal fluid[49,50] and is thought to contribute to central fatigue.[51]

Also during progressive incremental exercise, heart rate increases above baseline resting heart rate in relation to exercise intensity.[52] The increase is initially driven by withdrawal of vagal parasympathetic suppression of the heart.[53,54] This is followed by further concomitant vagal withdrawal and increased sympathetic stimulation through the cardiac plexus and release of epinephrine and norepinephrine from the adrenal medulla.[55-57] The increase in the chronotropic and inotropic events of the heart that follow directly raises baseline cardiac output as cardiac reserve is used. The heart rate will continue to increase to support exercise demands until an athlete attains his or her maximum heart rate and reach exhaustion.

The Borg RPE scale represents a 6 to 20 numeric scale that has been used in many studies to help quantify subjective participant perception of exercise intensity. Rating of perceived exertion has been linked to muscle force output,[58] exercise heart rate, and BLC.[59] During incrementally challenging exercise, RPE should gradually increase in relation to exercise intensity until a person reaches an RPE score of 20.

The purpose of this study was to quantify the impact thoracolumbar CMT had on immediate exercise performance by measuring BLC, exercise heart rate, and RPE during a treadmill-based graded exercise test (GXT).

Methods

This study was approved by the Texas Chiropractic College Research and Human Subjects Committees.

Study design and setting

This was a single-blind, randomized, controlled trial of the immediate impact thoracolumbar CMT had on exercise performance during a GXT. Twenty participants were randomly and equally assigned to 1 of 2 groups: AB (age = 27.0 ± 3.9 years, height = 1.69 ± 0.08 m, body mass = 68.6 ± 7.9 kg: mean ± SD) or BA (age = 27.9 ± 3.6 years, height = 1.67 ± 0.10 m, body mass = 74.1 ± 14.4 kg). The study involved 1 week of rest in between each of the 2 conditions: A (prone Diversified T12-L1 CMT) vs B (no CMT). Participants engaged in a treadmill GXT 5 minutes after each week's baseline condition (A or B). Outcome measures were BLC, exercise heart rate, and RPE recorded after 3-minute stages during a GXT as illustrated in Fig 1A and B. The test continued until the participant achieved greater than 8 mmol/L blood lactate, which correlates with maximal to near-maximal exercise effort. Each group, AB and BA, was composed of 5 men and 5 women. The laboratory room temperature was regulated as close as possible to 22°C.

Randomization and blinding

Group assignment was determined by drawing random slips of paper with group designation on