
ORIGINAL RESEARCH

COMPARISON OF TRUNK AND LOWER EXTREMITY MUSCLE ACTIVITY AMONG FOUR STATIONARY EQUIPMENT DEVICES: UPRIGHT BIKE, RECUMBENT BIKE, TREADMILL, AND ELLIPTIGO®

Lucinda Bouillon, PT, PhD¹

Ryan Baker, PTA, SPT¹

Chris Gibson, PTA, SPT¹

Andrew Kearney, PTA, SPT¹

Tommy Busemeyer, PTA, SPT¹

ABSTRACT

Background: Stationary equipment devices are often used to improve fitness. The ElliptiGO® was recently developed that blends the elements of an elliptical trainer and bicycle, allowing reciprocal lower limb pedaling in an upright position. However, it is unknown whether the muscle activity used for the ElliptiGO® is similar to walking or cycling. To date, there is no information comparing muscle activity for exercise on the treadmill, stationary upright and recumbent bikes, and the ElliptiGO®.

Purpose/Hypothesis: The purpose of this study was to assess trunk and lower extremity muscle activity among treadmill walking, cycling (recumbent and upright) and the ElliptiGO® cycling. It was hypothesized that the ElliptiGO® and treadmill would elicit similar electromyographic muscle activity responses compared to the stationary bike and recumbent bike during an exercise session.

Study Design: Cohort, repeated measures

Methods: Twelve recreationally active volunteers participated in the study and were assigned a random order of exercise for each of the four devices (ElliptiGO®, stationary upright cycle ergometer, recumbent ergometer, and a treadmill). Two-dimensional video was used to monitor the start and stop of exercise and surface electromyography (SEMG) were used to assess muscle activity during two minutes of cycling or treadmill walking at 40-50% heart rate reserve (HRR). Eight muscles on the dominant limb were used for analysis: gluteus maximus (Gmax), gluteus medius (Gmed), biceps femoris (BF), lateral head of the gastrocnemius (LG), tibialis anterior (TA), rectus femoris (RF). Two trunk muscles were assessed on the same side; lumbar erector spinae at L3-4 level (LES) and rectus abdominus (RA). Maximal voluntary isometric contractions (MVIC) were determined for each muscle and SEMG data were expressed as %MVIC in order to normalize outputs.

Results: The %MVIC for RF during ElliptiGO® cycling was higher than recumbent cycling. The LG muscle activity was highest during upright cycling. The TA was higher during walking compared to recumbent cycling and ElliptiGO® cycling. No differences were found among the the LES and remaining lower limb musculature across devices.

Conclusion: ElliptiGO® cycling was found to elicit sufficient muscle activity to provide a strengthening stimulus for the RF muscle. The LES, RA, Gmax, Gmed, and BF activity were similar across all devices and ranged from low to moderate strength levels of muscle activation. The information gained from this study may assist clinicians in developing low to moderate strengthening exercise protocols when using these four devices.

Level of evidence: 3

Keywords: Cycling, electromyography, elliptical, ergometers, lower extremity, muscle activity, treadmill

CORRESPONDING AUTHOR

Lucinda Bouillon, PT, PhD

Associate Professor of Physical Therapy

College of Health Sciences

2801 W. Bancroft St., Mail Stop 119

The University of Toledo

Toledo, Ohio 43606-3390

Phone: 419.530.6697; Fax: 419.530-4780

E-mail: lucinda.bouillon@utoledo.edu

¹ The University of Toledo, Toledo, OH, USA