

Effect of Self-Regulated Exercise Intensity on Endothelial Function in Men with Coronary Artery Disease

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Abstract

Background: Physiologically based exercise prescriptions normally involve identifying an intensity range that elicits a predetermined VO_2 or heart rate. In many instances prescribed exercise that exceeds an individual's preferred level of intensity may establish a negative attitude toward physical activity. Longitudinal studies report that participants tend to deviate from physiologically based prescribed levels of intensity in favour of apparently preferred levels. Self-regulated exercise intensity may increase enjoyment and promote adherence by allowing individuals successfully complete an activity within their perceptual preference range and without undue physiological strain. The purpose of this study is to examine the effect of self-regulated exercise intensity on endothelial function (a validated surrogate measure of early atherosclerosis) in men with coronary artery disease (CAD).

Methods: Eight men with CAD (65.7 ± 4.5 y, $\text{VO}_{2\text{peak}} 18.6 \pm 4.1$ ml·kg⁻¹·min⁻¹, BMI 29.7 ± 3.3 kg·m⁻²) underwent 20 min of treadmill walking at a self-regulated intensity. Endothelial-dependent dilation (EDD) of the brachial artery was assessed before and 1 h following the acute bout of exercise. Vessel diameter was determined using high resolution vascular ultrasonography (SonoSite, MicroMaxx) from flow mediated dilation (FMD) following 5 min of forearm occlusion. Endothelial-independent dilation (EID) was measured at min 1, min 3 and min 5 following the administration of glyceryl trinitrate (0.4 mg).

Results: Subjects self-selected an average treadmill velocity of 5.3 km·h⁻¹ and a grade of 0.7%. This intensity equated to 65.7% $\text{VO}_{2\text{peak}}$, and RPE 12. Compared to baseline, FMD was significantly increased at 1 min and 3 min post occlusion at 60 min following the acute bout of self-regulated exercise. There was no change in EID in response to the acute bout of exercise.

Conclusions: These results indicate a beneficial effect of self-regulated exercise on endothelial-dependent vascular function in men with CAD.

Introduction

Endothelial dysfunction refers to the physiological dysfunction of normal biochemical/biophysical processes undertaken by the endothelium that results in a reduced capacity to maintain homeostasis. This leads to the development of pathological inflammatory processes and vascular disease. Acute and chronic exercise have been shown to improve endothelial function in individuals with CAD. Allowing individuals to use effort perception to self regulate their preferred intensity may encourage the development of intrinsic motivation, a central element in promoting adherence to exercise. Exertional feedback is commonly used to regulate the pace of many daily activities and is often done without conscious awareness. In a recent study it was found that 86% of women involved in aerobic exercise used effort perception exclusively to determine exercise intensity (1). The purpose of this study was to examine the effect of self regulated exercise on endothelial function in men with CAD

Methods

A total of 8 men with CAD (65.7 ± 4.5 y; $\text{VO}_{2\text{peak}} 28.0 \pm \text{ml} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$) visited the Vascular Research Unit (VRU) on 2 separate occasions. During the first visit, subjects undertook a maximal exercise test to determine $\text{VO}_{2\text{peak}}$. During the second visit the subjects undertook a 20 min bout of self-regulated treadmill exercise. Endothelial function was assessed before and 1 h after the exercise session.

Visit 1: The maximal exercise test was undertaken on a treadmill using a ramp protocol. Breath by breath expired O_2 and CO_2 were measured using open circuit spirometry. Subjects were continuously monitored with a 12 lead ECG.

Visit 2: Subjects arrived to the VRU after an overnight fast. Endothelial dependent dilation and endothelial independent dilation were assessed before and 1 h after a 20 min bout of exercise at a self regulated intensity (Figure 1).

Arterial diameter was assessed offline using custom designed software (Figure 2)

Results

Subjects self-selected an average treadmill velocity of 5.3 km·h⁻¹ and a grade of 0.7%. This intensity equated to 65.7% $\text{VO}_{2\text{peak}}$, and RPE 12.

Compared to baseline EDD was significantly increased, at 1 min (Figure 3A) and 3 min (Figure 3B) post occlusion, 1 h following the acute bout of self regulated exercise compared to baseline. There was significant difference in EDD at 5 min post occlusion. There was no change in endothelial independent dilation in response to the acute bout of exercise.

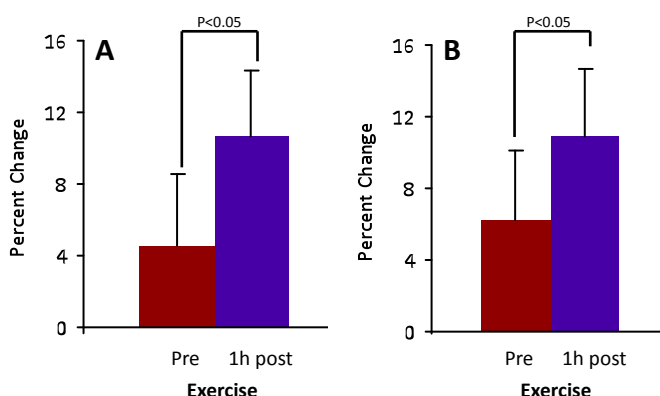


Figure 3. Flow Mediated Dilation at 1 min (A) and 3 min (B) post occlusion

Conclusion

Compared to baseline, flow-mediated dilation was significantly increased at 60 min following 20 min of self-regulated exercise in patients with CAD

Bibliography

1. Johnson, J.H. and Phipps, L.K. Preferred Method of Selecting Exercise Intensity in Adult Women. Journal of Strength and Conditioning Research. 20(2), p446-449, 2006.

Experimental Protocol

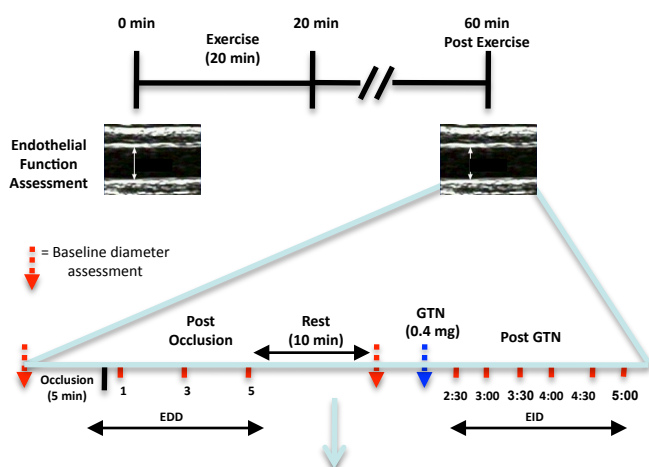


Figure 1. Assessment of Endothelial Function

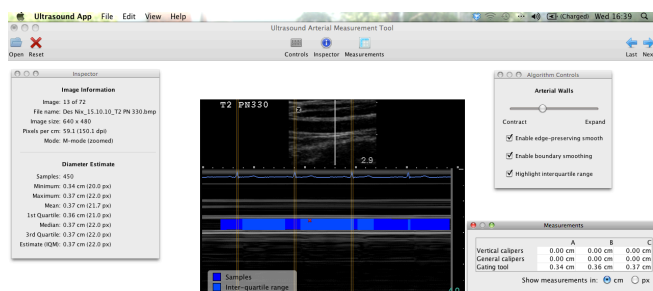


Figure 2. Custom designed software (CLARITY: Centre for Sensor Web Technologies)