

ABSTRACT

External Counter Pulsation (ECP) therapy is a non-invasive treatment that enhances blood flow and delivers oxygenated blood to the extremities through the sequential compression of the lower limbs during diastole. It has primarily been used to treat patients with chronic angina pectoris/congestive heart failure. The aim of the study was to determine if ECP therapy impacts performance and recovery after strenuous exercise in healthy subjects. Fifty-seven amateur athletes (27 males, average 38.9 years) completed three consecutive days of weighted lower body exercises and a 10k time trial on a stationary bicycle. Balance and jump performance were tested before the exercise circuit (PRE) and after the time trial (POST) each day. Subjects were randomly assigned to either 30 min of ECP therapy or 30 min of rest wearing uninflated ECP cuffs. Repeated measures ANOVA was used to test within group differences. Average cycling time significantly decreased from visit 1 to visit 3 for the ECP group compared with the control group (1,524 to 1,432 vs. 1,499 to 1,479 sec; $p < .05$). Balance improved significantly for the ECP group from POST visit 1 to PRE visit 2 (74.8 to 67.9 vs. 75.2 to 73.6; $p < .05$). Jump explosiveness was maintained from POST visit 1 to PRE visit 2 for the ECP group, and decreased significantly for the control group (.403 to .404 vs. .363 to .393; $p < .05$). ECP may impact performance by enhancing recovery and ability to perform through vasodilation and increased blood flow.

INTRODUCTION

- External counter pulsation (ECP) therapy is an effective, non-invasive treatment for angina and heart failure.¹
- The treatment consists of the sequential inflation of compression cuffs secured around the patient's calves, thighs, and buttocks. During diastole, the cuffs rapidly and sequentially inflate starting from the calves and proceeding upwards, followed by simultaneous decompression during systole.
- The technique of counter pulsation produces an acute therapeutic effect by increasing blood flow, promoting venous return, increasing cardiac output, and reducing the heart's workload.²
- While ECP is approved for use in non-diseased populations, there has been little research done to evaluate the impact of the therapy on healthy individuals.
- The mechanism through which ECP works, namely enhancing blood flow through vasodilation, is one that should theoretically be effective for recovery after exercise and other strenuous activity that produces muscle soreness.

OBJECTIVE

- To determine if ECP therapy impacts performance and recovery after exercise in healthy, active individuals.

METHODS

Participants

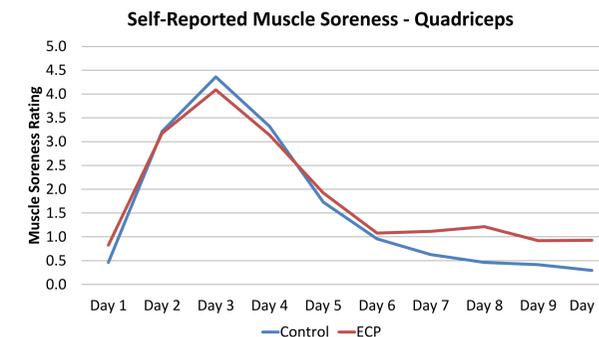
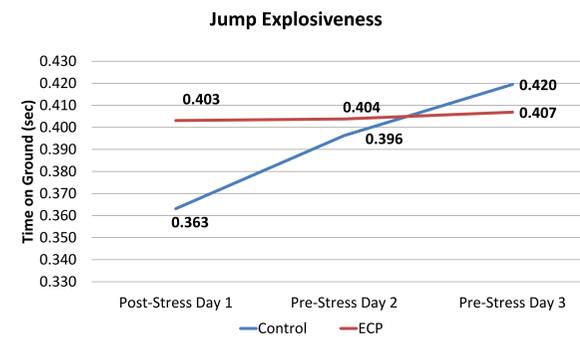
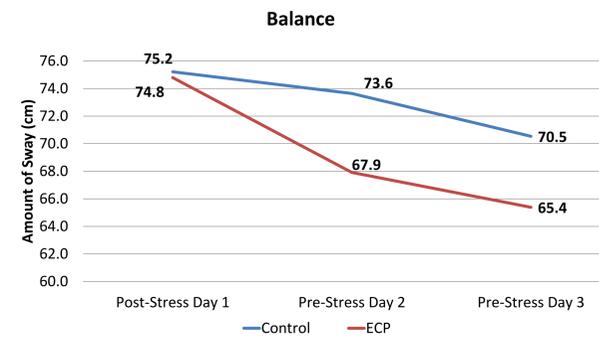
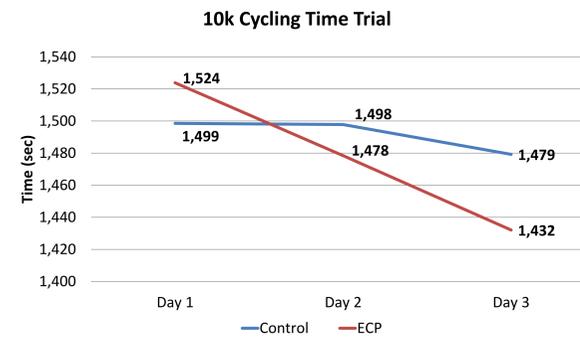
Fifty-seven amateur athletes, 27 males and 30 females, aged 38.9 ± 11.6 years, participated in this study. Qualified subjects for this study were 18 to 59 years old, exercised at least twice a week for twenty minutes at a time, and did not have any contraindications to ECP therapy.

Design

- Subjects were required to participate in three two-hour study visits over three consecutive days.
- During each study visit, subjects engaged in a 20 min lower-body exercise circuit while wearing a weighted vest containing 12-15% of their body weight and then completed a 10k time trial using an indoor cycling trainer.
- Balance and jump tests were conducted both before the exercise circuit (PRE) and following the cycling time trial (POST). Balance was the amount of postural sway over 20 sec for both right and left leg, measured individually using a force plate. Jump explosiveness was ground time between consecutive jumps, measured using a contact mat.
- Subjects who were randomly assigned to the treatment condition then received 30 min of ECP therapy, while control subjects passively recovered for 30 min while wearing thigh and calf cuffs, but receiving no compression.
- Self-report measures were completed by subjects at the beginning of each study visit and for seven days following their final visit.

RESULTS

- Repeated measures ANOVA was used to examine within group differences for cycling time, balance ability, and jump performance.
- Average cycling time significantly decreased from visit 1 to visit 3 for the ECP group compared with the control group (1,524 to 1,432 vs. 1,499 to 1,479 sec; $p < .05$).
- Although balance for both groups generally improved, the ECP group had significantly less sway from POST visit 1 to PRE visit 2 (74.8 to 67.9 vs. 75.2 to 73.6; $p < .05$).
- Jump explosiveness was maintained from POST visit 1 to PRE visit 2 for the ECP group, while performance on this test decreased significantly for the control group over the same period (.403 to .404 vs. .363 to .393; $p < .05$).
- There were no significant differences between groups for self-reported muscle soreness for any of the examined muscle groups.



CONCLUSION

- On average, subjects who received ECP therapy after strenuous exercise improved cycling time trial performance, improved balance, and maintained jump explosiveness.
- This study provides evidence that there is a similar impact from ECP therapy for healthy subjects as is seen for clinical populations suffering from cardiac conditions such as angina and congestive heart failure whereby significant increases in exercise time were observed after treatment compared to controls.^{3,4}
- It also provides evidence that the benefits of ECP therapy for healthy subjects can be achieved with much lower dosage rates than that required in cardiac and other disease populations.
- Mechanisms through which ECP could potentially impact performance are enhanced recovery by means of increased transdermal oxygen concentration and blood flow. Additionally, ECP has an immediate impact on endothelium function and nitric oxide levels,^{5,6} leading to increased vasodilation.

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ACKNOWLEDGMENTS

- This project was funded by Stage 2 Innovations.
- We thank all members of the UC San Diego EPARC lab for their assistance in the development of the study protocol and for their help with data collection and cleaning.
- We also thank our scheduling coordinator, Debora Goodman, for all of her help with recruitment and data collection.
- Special thanks to Function Smart Physical Therapy for allowing us to use their facility as our main study site.

MATERIALS AND APPARATUS

