

Cardiac and Metabolic Benefits of Robotic-Assisted Gait Training After Spinal Cord Injury

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INTRODUCTION

A randomized controlled trial is currently being conducted at NRH and the University of Miami to quantify the effects of 6 months of robotic weight-supported treadmill training (RBWSTT) on selected measures of fitness in persons with a spinal cord injury (SCI).

The hypothesis is that long-term Lokomat[®] ambulation training will result in a cardiovascular training effect defined by a decreased oxygen consumption, heart rate, and respiratory exchange ratio at a matched sub-peak workload.



Figure 1. Metabolic testing during Lokomat[®] ambulation.

METHODS

Individuals with C4 to T12 AIS C or D SCI who are less than 6 months post-injury are being recruited.

The control group receives usual rehabilitative care and the exercise group receives additional Lokomat[®] training for one hour, three times a week, for 6 months.

The Lokomat[®] training protocol includes initial training speed of 1.9 km/hr, progressing to 3.2 km/hr, and body-weight support and robot assistance are decreased as tolerated per training session to increase the workload. During the training sessions, participants walking in the Lokomat[®] are encouraged to actively move their legs.

Changes in metabolic responses are assessed for both groups by a sub-maximal Lokomat[®] walk test (Figure 1). Outcome measures are collected at baseline, 3 months, and 6 months. Reported measures include peak VO₂ and heart rate. Exercise trends were determined through mean percent change.

RESULTS

Currently 9 participants have completed this study (5 intervention and 4 control). Age range of 24-59 years, with an average age of 44.1 years.

Comparison of baseline to 6-month follow-up data:

- Both groups have a 5.1% increase in peak VO₂.
- The training group demonstrates an 18% decrease in resting heart rate and a 36% decrease in peak heart rate.
- The usual care group demonstrates only an 8.4% decrease in resting heart rate and a 1.4% decrease in peak heart rate.

CONCLUSION

The 6-month test data shows a dramatic decrease in resting and peak heart rates, and a small decrease in RER at peak exercise for the training group. These interim results demonstrate a trend towards a cardiovascular adaptation after 72 sessions of Lokomat[®] training.

REFERENCES

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| | Lokomat Group | | | Control Group | | |
|----------------------------------|---------------|---------|-------|---------------|---------|-------|
| | Baseline | 6-month | %Δ | Baseline | 6-month | %Δ |
| Rest HR (bpm) | 82.0 | 67.2 | -18.0 | 87.3 | 80.0 | -8.4 |
| Peak HR (bpm) | 131.8 | 84.4 | -36.0 | 107.0 | 105.5 | -1.4 |
| Peak VO ₂ (ml/kg/min) | 7.8 | 8.2 | +5.1 | 7.8 | 8.2 | +5.1 |
| V _E (L/min) | 16.5 | 16.9 | +2.4 | 23.7 | 26.3 | +11.0 |
| RER | 0.96 | 0.94 | -2.1 | 0.93 | 1.02 | +9.7 |

Figure 2. Comparison of base line and 6-month exercise test data. All values are group means. HR= heart rate; bpm=beats per minute; VO₂=oxygen uptake; V_E=minute ventilation; RER=respiratory exchange ratio.

Acknowledgements

This project is funded by NIDRR grant #H133B031114, the Rehabilitation Research and Training Center on SCI: Promoting Health and Preventing Complications through Exercise.

