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.

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 VO_2 and heart rate. Exercise trends were determined through mean percent change.

Figure 1. Metabolic testing during Lokomat® ambulation.

	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; VO_2=oxygen uptake; V_E=minute ventilation; RER=respiratory exchange ratio.

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 VO_2.
- 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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