



### BACKGROUND

- Ambulation is compromised in many of the 10,000 yearly survivors of a traumatic SCI and 250,000 individuals living with chronic SCI<sup>1,2</sup>
- BWSTT allows early gait training with individuals who are unable to bear full weight through the lower extremities without overcompensating with spared motor function<sup>3</sup>
- The AlterG® is relatively new type of gravity reducing treadmill that is less complex, less time consuming, and less invasive than previous gravity reducing treadmills
  - Allows for controlled stress to healing or impaired tissues
  - Allows for controlled weight bearing, promoting increase in bone mass



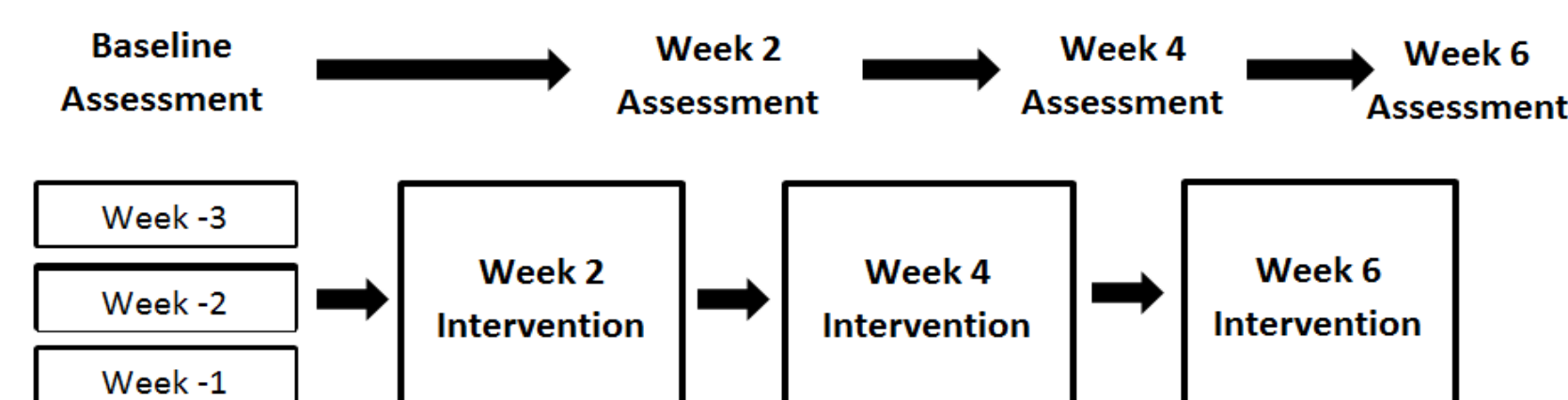
### PURPOSE



- The purpose of this study is to determine if locomotor training using the AlterG has a positive impact on the gait mechanics and functional ambulation of individuals with chronic incomplete spinal cord injury
- We hypothesized that locomotor training using the AlterG, antigravity rehabilitation treadmill would improve step length, stride length, step width, endurance, gait speed, and ambulation distance in individuals with chronic incomplete spinal cord injuries over a six week period.

### METHODS

A replicated single-subject A-B design was implemented and measurements were taken three consecutive weeks prior to the start of the initial intervention session and at the completion of weeks 2,4,6 during the intervention phase using five outcome tools



#### Protocol:

- Calculating initial speed: average of 3 baseline 2MWT in MPH → subtract 20% = 80% starting speed
- Speed progress: 0.1 to 0.3 MPH every other treatment session
- BWS: each subject started with 50% of their body weight eliminated
- BWS Progression: decreased amount of body weight support 5% every other treatment session while altering speed progression
- Duration: 5 minute warm-up and cool down period. Weeks 1 & 2 : 30 minute duration. Weeks 3-6: 45 minute duration.

#### Outcome Measurements:

- GAITrite System
- WISCI-II
- RMI
- COSMED K4b<sup>2</sup> Portable Metabolic System
- 2MWT
- LEMS

#### Data Analysis:

- Two Standard Deviation Band Method
  - Step Length
  - Endurance
  - Pre- and Post- Intervention comparison
    - COSMED K4b<sup>2</sup> Metabolic System
  - Stride Length
  - Gait Speed
  - Step Width
  - Ambulation Distance

### RESULTS

Table 1: Subject Demographics

Subject	Age	Gender	Injury Date	Level of Injury	Nature of Injury	ASIA Score
S1	52	Female	May 2012	C4-C6	Progressive	D
S2	22	Female	March 2011	T10-T11	Traumatic	D

#### SUBJECT 1 RESULTS

Table 2: Subject 1 Intervention

Week	Time (minutes)	Percent BWE (%)	Speed (mph)
1	30	50	2.0
2	30	50	2.5
4	45	35	2.9
6	45	20	3.1

Alterations were made in percent BWE during week 4 due to an increase number of tripping incidents during ambulation.

Table 3: Subject 1 Self-Paced Spatiotemporal Parameters of Overground Locomotion

Parameter	Baseline Average +/- 2SD	Week 2	Week 4	Week 6
Step Time (sec) R	0.56 +/- 0.01	0.56	0.54*	0.548*
Swing Time (sec) R	0.34 +/- 0.004	0.35*	0.33*	0.336*
Stance Time (sec) L	0.80 +/- 0.01	0.81*	0.77*	0.784*
Double Support Time (sec) L	0.50 +/- 0.02	0.45*	0.44*	0.454*

Areas of statistically significant improvements made in self-paced ambulation. During faced paced locomotion the only significant differences were increased toe-in on the right.

Table 4: Subject 1 Metabolic Cost

	Pre-Intervention	Post-Intervention
Respiratory Exchange Ratio	0.76	0.85
VO <sub>2</sub> (ml/Kg/min)	15.73	15.89

No statistically significant improvements made in metabolic cost.

Table 5: Subject 1 Functional Outcome Measurement Tools

	Baseline +/- 2SD	Week 2	Week 4	Week 6
LEMS	49.67 +/- 14.47	45	46	46
WISCI II	20 +/- 0	20	20	20
RMI	14 +/- 0	14	14	14
2MWT	106.40 +/- 6.96	107.82	101.0	106.7

No statistically significant improvements made in functional outcomes.

#### SUBJECT 2 RESULTS

Table 6: Subject 2 Intervention

Week	Time (minutes)	Percent BWE (%)	Speed (mph)
1	30	50	1.0
2	30	40	1.7
4	45	25	2.2
6	45	30	2.4

Alterations made in percent BWE during week 6 due to an increase in LE tone during week 4 ambulation.

Table 7: Subject 2 Self-Paced Spatiotemporal Parameters of Overground Locomotion

	Baseline Average +/- 2SD	Week 2	Week 4	Week 6
Cadence	71.50 +/- 3.82	71.8	76.4*	75.7*
Step Time (sec) L	0.85 +/- 0.04	0.83	0.97*	0.80*
Swing % of Cycle L	33.77 +/- 0.83	33.5	32.6*	34.8*
Stance % of Cycle L	66.27 +/- 0.76	66.5	67.3*	65.2*
Double Support % Cycle L	36.13 +/- 1.17	34.9*	33.8*	31.4*

Areas of statistically significant improvements made in self-paced ambulation.

Table 8: Subject 2 Fast-Paced Spatiotemporal Parameters of Overground Locomotion

	Baseline Average +/- 2SD	Week 2	Week 4	Week 6
Velocity	77.93 +/- 9.27	84.5	90.5*	94.8*
Step Length (cm) L	59.09 +/- 2.29	63.20*	65.39*	69.70*
Swing % of Cycle L	35.47 +/- 0.58	33.4*	36.5*	38.0*
Stance % of Cycle L	64.53 +/- 0.58	66.6*	63.5*	62.0*

Areas of statistically significant improvements made in fast-paced ambulation.

Table 9: Subject 2 Metabolic Cost

	Pre-Intervention	Post-Intervention
Respiratory Exchange Ratio	0.72	0.84
VO <sub>2</sub> (ml/Kg/min)	14.70	17.08

No statistically significant improvements made in metabolic cost.

Table 10: Subject 2 Functional Outcome Measurement Tools

	Baseline +/- 2SD	Week 2	Week 4	Week 6
LEMS	47.33 +/- 6.11	44	50	51
WISCI II	19 +/- 0	19	19	19
RMI	14 +/- 0	14	14	14
2MWT	70.12 +/- 12.07	74.42	70.0	72.78

No statistically significant improvements made in functional outcome.

### DISCUSSION/CONCLUSIONS

- Statistically significant improvements: Self-paced Spatiotemporal Parameters (*Subject 1 & 2*) and Fast-paced Spatiotemporal Parameters (*Subject 2*)
- No statistically significant improvements: Fast-paced Spatiotemporal Parameters (*Subject 1*); Metabolic Cost (*Subject 1 & 2*); Functional Outcome Measurements (*Subject 1 & 2*)
- Qualitative Improvements of *Subject 1*: self reported improvement in reciprocal gait pattern, increased confidence in ambulatory abilities, and decreased anxiety about falling.
- Qualitative Improvements of *Subject 2*: decrease reliance on SPC in busy environments and increased safety and balance with increase in ambulatory speed
- A six-week training program using the AlterG® can improve spatiotemporal gait parameters in individuals with incomplete SCI between C5-T10
- Results of the study are in partial agreement with the literature about the positive effects of BWSTT in individuals with incomplete SCI
- Further research needs to be conducted on validating the impact of locomotor training with the AlterG® on individuals with incomplete SCI as well as monitoring their QOL and well-being

### REFERENCES

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