

The Effects of Body Weight Supported Treadmill Training on Gait, Balance, and Endurance in a Patient with Chronic Stroke

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Introduction

- Body Weight Supported Treadmill Training (BWSTT) is a form of locomotor training that incorporates central pattern generators (CPG), principles of motor learning, and neuroplasticity
 - CPG: Spinal networks reflexively produce rhythmic flexor and extensor movement independent of supraspinal involvement when limbs are moved in a pattern consistent with normal locomotion¹
 - Motor Learning: Repetitively trains entire gait cycle and forces use of involved limb^{2,3}
 - Neuroplasticity: Forced use studies using fMRI shows neuroplastic changes even up to 15 years post stroke⁴
- BWSTT has been shown to contribute to functional changes in speed and symmetry of gait, endurance and balance scores in patients with acute and chronic stroke⁵
 - Studies have shown training at speeds closer to normal ambulation contributes to greater speed improvement⁶
 - No conclusive studies on frequency/duration of training⁷
 - 4-45 minutes per session; 2-5 days per week; 3-9 weeks
- The purpose of this report was to determine the effect of BWSTT on gait, balance, and endurance in a patient with chronic hemiparesis and significant gait dysfunction in an outpatient physical therapy clinic

Subject

- The patient was a 50 year old woman who suffered a right hemorrhagic MCA stroke 9/2005 in Mexico with resultant spastic L hemiparesis
- Did not receive inpatient rehabilitation until 11/2006 when she moved to the United States to live with her daughters
- Function as of 2/2007:
 - Ambulated community distances using a hemiwalker or wide based quad cane with supervision to minimal assistance
 - Rigid AFO for L ankle to control inversion and plantarflexion
 - Significant lean to R throughout gait with decreased weight bearing through L leg
 - Positive L hip hike and circumduction due to poor motor control of LLE
 - Decreased step length RLE
- Transfers and bed mobility with minimal assistance
- Fearful to ambulate without a device, but able to complete with moderate assist of 1 person up to 75 feet

Hypothesis

- A patient with chronic stroke and delayed initiation of inpatient rehabilitation will experience improvements in balance and speed and symmetry of gait with the addition of BWSTT to outpatient physical therapy plan of care, based on principles of neuroplasticity, motor learning, and central pattern generators.

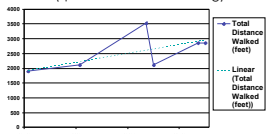
Intervention

- Outcome measures: Berg Balance Assessment, Fugl Meyer Motor Scale (LE portion), 6-minute walk test (endurance), 10 meter walk test (speed), spatiotemporal gait parameters using GaitMatII™ system
 - Measures taken pre-intervention and post-intervention
 - Data taken daily for distance tolerated
- BWSTT incorporated into outpatient PT plan of care 3 days per week
 - 4-5 Trials of 3-5 minutes each (as tolerated), speeds 1.2 to 2.0 mph

Outcomes

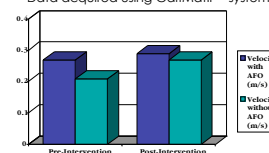
- 12% increase in endurance per 6 min walk test
- 25% improvement in LE Fugl-Meyer score
- 30% improvement in Berg Balance Scale score
 - Pt able to attempt all tasks of the Berg at the conclusion of the intervention.
 - Too fearful to attempt all tasks prior to the intervention
- 7% increase in gait speed per GaitMatII™ analysis
- Pt's family reported increased confidence with ambulation in the home, taking small steps, assisted by family, without a device
- Pt initially required assist of 3 for BWSTT, by 5/10/07 was able to complete total training time with assist of only 2

Total Distance Walked on Treadmill (speed x total time walking)



Outcomes (cont'd)

Velocity over 10 meters
Data acquired using GaitMatII™ system



Clinical Measures	Baseline 4/29/2007	Post 11 Treatments 5/23/2007
10m with HW (m/s)	0.253	0.246
10m with SBQC (m/s)	0.238	0.241
6 min walk distance (feet)	251	259
LE Fugl-Meyer Motor Score (max = 34)	8	10 (25%)
Berg Balance Score (max = 56)	10	13 (30%)
Gait Lab Measures	3/28/2007	5/23/2007
Velocity with AFO (m/s)	0.27	0.28
Velocity without AFO (m/s)	0.21	0.27
Cadence with AFO (steps/min)	55	58
Cadence without AFO (steps/min)	36	54
R double limb support with AFO (s)	0.52	0.47
R double limb support without AFO (s)	2.07	0.37
L double limb support with AFO (s)	0.44	0.33
L double limb support without AFO (s)	0.54	0.29
R stance with AFO (s)	1.78	1.75
R stance without AFO (s)	3.09*	1.79
L stance with AFO (s)	1.33	1.15
L stance without AFO (s)	2.98*	1.1

Conclusions

- A patient with chronic spastic hemiparesis can demonstrate gains in quality of ambulation, balance and endurance with 12 sessions of BWSTT as part of an outpatient physical therapy program
 - Notable progress made on treadmill with BWSTT
 - Consistent with motor learning theories of repetition and task-specific practice
 - Improved progress made in the 3rd and 4th weeks of the intervention may suggest that, given the patient's low level of motor recovery (per Fugl-Meyer), further treatment with BWSTT may have been beneficial in this case.
 - The patient did not show clinically significant improvement in ambulation over ground
 - i.e. no improvement in need for assistive device, minimal distance and speed improvement, minimal balance improvement

Discussion

- Berg Balance Scale was not sensitive enough to capture mild balance improvements in this particular patient
 - Pt fearful to attempt all tasks of Berg initially, showed increased confidence and decreased assistance to complete all tasks at the end of the intervention, but still required min assist to complete most tasks.
- LE Fugl-Meyer motor score of a patient with chronic hemiparesis should be considered prior to initiation of BWSTT program, as a more involved patient may require increased training time, or may not be able to translate task-specific gains on the treadmill itself to over ground ambulation
 - Affected by reimbursement/insurance constraints.
- Given family's subjective reports of improvement, a Quality of Life Scale or subjective report scale is relevant to include with this study to capture clinically relevant improvements
- Strength of data is low given single subject design
 - Collected in outpatient physical therapy setting, unable to attribute treatment affect solely to BWSTT as ethically, the patient required additional transfer training, strength training, ROM as part of her plan of care

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