

ACADEMY OF PEDIATRIC PHYSICAL THERAPY

Body-Weight–Supported Treadmill Training: Using Evidence to Guide Physical Therapy Intervention

Definition

Body-weight–supported treadmill training (BWSTT) is an intervention used by pediatric physical therapists in a variety of practice settings. BWSTT provides a system for working on strength, endurance, and task-specific gait training. During BWSTT, the body weight of the child is unloaded by adult assistance (Figure 1) or by a counter-weight harness system placed over a treadmill (Figures 2 and 3). The legs are advanced actively by the child, with manual assist of a therapist or family/caregiver (Figure 2) or robotically (Figure 3).



Figure 1. Adult Assistance for Body-Weight Support



Figure 2. Litegait Used Over Treadmill With Therapist Assisting to Advance Limbs

Figure 3. Child on the Lokomat With Robotic Assistance to Advance limbs and Therapist Controlling Parameters Through Computer Interface



Evidence

The rationale for use of BWSTT is supported by current motor learning principles specifying active engagement in task performance over time for neuroplasticity to occur.¹ BWSTT allows repetition and intensity of training in the task-specific practice of walking. Numerous research studies specific to the use of BWSTT for children have been published. The majority of studies suggest improvement at the levels of body functions and structure,² eg, postural control and some gait parameters and activity/participation² (eg, self-selected walking speed). Recent systematic reviews of BWSTT in children describe weak evidence with no randomized clinical trials.^{3,4,5,6} However, the evidence for BWSTT varies by diagnosis, with the strongest evidence suggesting positive outcomes in children with Down syndrome^{7,8,9} and limited evidence for children with cerebral palsy^{5,10,11,12} and spinal cord injury.^{14,15} Studies also describe the use of BWSTT for children with myelomeningocele¹⁶ and adults with Guillain-Barre,¹⁷ stroke,¹⁸ and traumatic brain injury.¹⁹ No adverse side effects have been reported with the use of BWSTT in children.

Best Practice

The decision to incorporate BWSTT into a plan of care for a child should be made in collaboration with the child, family, and members of the rehabilitation team. Most studies describe a period of BWSTT followed by locomotor training over ground within a single treatment session. Valid and reliable measures of activity and participation should be used to evaluate outcomes with BWSTT. Possible resources for measurement of outcomes include:

- Measurement of spatiotemporal gait parameters using pedographs, eg, paper or electronic walkways^{13,20,21}
- Gait speed using timed walk tests, eg, 10-Meter-Walk Test, 6-Minute-Walk Test²²
- Gross Motor Function Classification System (GMFCS) Sections E & R23
- Gross Motor Function Measure Section 66 (Dimensions D & E)^{24,25}
- Functional Independence Measure for Children II (WeeFIM II)²⁶
- Canadian Occupational Performance Measure (COPM)²⁷
- Timed Up and Go Test (TUG)²⁸
- Goal Attainment Scaling (GAS)²⁹
- Standardized Walking Obstacle Course (SWOC)³⁰
- Pediatric Evaluation of Disability Inventory (PEDI)³¹

BWSTT has been used as a physical therapy intervention in multiple settings, including schools, outpatient clinics, and inpatient rehabilitation settings.^{10,15,32,33} Although specific equipment is needed, studies report the use of BWSTT as a home program intervention completed by parents with the support of physical therapy.^{9,33} Specific protocols for use of BWSTT are currently unavailable, however, frequently reported parameters suggest guidelines (Table).

Table. Guideline for Use of Body-Weight–Supported Treadmill Training

Frequency	2-5 days per week
Session length	5-30 minutes per session (does not include setuo or getting on/off equipment)
Treadmill speed	.05 mph-3 mph
Percent body-weight support	Load stance limb

	Use least amount of body weight support to maintain erect postural alignment
Manual assistance	Least amount required for stepping Assist intra- and inter-limb coordination
Support using arms/hands	Fading use of handrails
Episode of treatment	2-16 weeks

Equipment

A variety of BWSTT equipment has been described, including custom-made portable treadmills⁹ (Carlin's Creations, www.carlinscreations.com/), LiteGait WalkAble over a GaitKeeper treadmill¹⁵ (Mobility Research, www.litegait.com), and the Lokomat, a robotically driven (motorized) gait orthosis^{37,38} (Hokoma, www.hocoma.ch/en/). Equipment costs and staff resources needed to implement this intervention vary significantly. Manually assisted BWSTT may require the assistance of 2-4 trained people to facilitate movement of the child's legs while supported in an upright position. Robotic-assisted BWSTT may offer a safer alternative, reducing the risk of injury to therapists if the child needs manual assistance with step control. This is especially true when BWSTT devices are used with larger children or children with more motor involvement.

Limitations

This document is not intended to provide comprehensive guidelines for physical therapists on the use of BWSTT. Physical therapists are encouraged to obtain and review current peer-reviewed literature in order to make informed clinical decisions prior to including this or any procedural intervention into a patient plan of care. The following Web sites are recommended to access these articles:

- PubMed (www.pubmed.gov): The National Institute of Health's database for medical literature. A bibliographic database of journals covering alternative and complementary therapies is accessible through PubMed. If studies found in searches were supported by federal dollars, the full research papers are now available at no cost.
- Cochrane Reviews (<http://www.cochrane.org/reviews/>): Consensus documents, meta-analyses, and systematic reviews on topics, if available.
- Hooked on Evidence (www.apta.org/hooke-donevidence/index.cfm): The evidence-based review of topics by the American Physical Therapy Association.
- Physiotherapy Evidence Database (PEDro) (www.pedro.org.au): The evidence-based review of topics by The George Institute of International Health and the University of Sydney.

Remember that even published research papers should be evaluated to determine the level of evidence and the extent to which the results can be generalized to practice. For assistance with evaluating research evidence, see The Guidelines for Critical Review Form, Quantitative Studies (<http://www.canchild.ca/en/can-childresources/resources/quantguide.pdf>).

Future Work

Additional research is needed to demonstrate the efficacy of BWSTT. The type of assistance provided to the child on the treadmill (robotic versus manual) also requires further investigation. Finally, more rigorous studies are needed to determine the effectiveness of BWSTT in different populations and the recommended parameters, eg, treadmill speeds, amount of body-weight support, session length and frequency, optimal episode of treatment including BWSTT.

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Web Sites for Photos Listed in Figures 1-3:

Figure 1: <http://www.kines.umich.edu>

Figure 2: <http://litegait.com>

Figure 3: <https://hocoma.com>

For More Information

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