Cerebrovascular Accident (CVA)
- >750,000 incidents of stroke in US annually.¹
- >85% of those entering rehab facilities require manual assist to walk short distances.²

Impact on Gait
3, 7, 11, 15, 16, 17, 18, 21
- Postural changes (flexion; side effects)
- Asymmetric gait
- Slower
- Decreased balance
- Increased fall risk

Other Neuro Populations
- Spinal cord injury ⁶
- Guillain-Barre syndrome
- Traumatic brain injury
- Brain tumor resection
- Multiple sclerosis
- Parkinson’s disease
- Polynephropathy
- Critical illness neuromyopathy

Home vs. Institution
- Walking independence is key factor for home vs. institution.³⁴
- Improved walking function is one of the most often expressed therapy goals. ¹⁴, 18, 19, 24
Traditional Gait Training

- Sitting trunk control
- Standing weight shift
- Parallel bars (hemi-bar)
- Assistive device/AFOs
- At discharge from rehab, typical gait distances are from 50 – 150 feet, often with contact guard assist.

Advantages
- Cost effective
- Clinicians are trained
- Minimal specialized equipment
- In various settings

Disadvantages
- More fatigue
- Less distance
- Reduced cardiovascular
- Slow pace
- Compensatory gait patterns

Unweighted Gait Training

- Harness system takes weight off person’s feet
- Initiate standing/walking practice earlier
- Eliminate fear of falls
- Gait training possible for people who cannot safely be guarded during traditional training

Initiate Rehab Earlier

- Shorter overall rehab stay with the additional “up time”
- Higher quality gait pattern earlier in rehab; develop less compensatory gait patterns
- Unweighted gait early in rehab; reduced falls after return home and into the community

Unweighted Gait Training

- Reduce fatigue; patient walks farther
- Increased repetition for motor learning
- Longer duration increases blood flow to affected areas of body and brain, for recovery

Increase in Gait Symmetry

- Therapist with hands free can facilitate swing through with the leg as well as upright posture at the trunk
- BWS results in improved trunk control, upright posture, better balance and less anterior tilt
- Greater hip extension, and increased gait symmetry, cadence, speed; this suggests improved gluteal muscle strength and stability
- Improved active dorsiflexion, less drop foot debility, less need for AFO use
Increase in Gait Symmetry

- Shown to improve activation of muscles per EMG 17
- Decreased Trendelenberg gait and circumduction gait; decreased need for assistance
- Decreased reliance on AFOs and assistive devices

Body Weight Supported Gait Training

- Greater improvements in 15
  - Cadence
  - Stride length
  - Stride time
  - Step length
  - Step time
  - Gait speed

“Both Body Weight Support Treadmill Training (BWSTT) and Over-Ground Body Weight Support gait training have been shown to improve gait symmetry, increase over ground walking speed, and improve functional gait independence.” 14

Limitations

- Visual biofeedback (such as virtual reality or having a mirror in front of the patient) does not seem to contribute to more symmetrical gait 28
- Fall risk factors (such as impulsivity, knee buckling, and losses of balance) are equal between traditional gait therapy and unweighted gait intervention 28

Unweighted Gait Interventions

Robotic Devices
- EksoGT (Exoskeleton)
  - https://eksobionics.com
  - $200,000
- Lokomat
  - $85,000 (without virtual reality)
  - $200,000 (with virtual reality)
- ReoAmbulator
  - www.orimus.com
  - Contact manufacturer for price

Ceiling Track Systems

- Zero-G
  - www.aretechllc.com
  - $28,000-$40,000
  - Architecture ceiling style and length of the track affect price.
- SafeGait
  - www.safegaitinternational.com
  - $60,000 for Active Model
  - $200,000 for 360 Model
- Bioness Vector
  - https://bionessvector.com/ullanos
  - $200,000

Treadmill Devices

- Biodex NStep
  - www.biodex.com/physical-medicine/products
  - $22,000 (treadmill included)
- Lokostation
  - www.woodway.com
  - $63,350 (treadmill included)
- Alter G
  - www.alterg.com
  - $27,000 (treadmill included)
Over Ground BWS Devices

- Arjo Walker
  - [https://www.rehabmart.com](https://www.rehabmart.com)
  - $4490
- Bungee Mobility Trainer
  - [www.medline.com](http://www.medline.com)
  - Order manufacturer for price
- Up’n’Go
  - [www.upwalking.com](http://www.upwalking.com)
  - $6,375
- Rifton E-Pacer
  - [www.rifton.com](http://www.rifton.com)
  - $5000 - $7000

Disadvantages of BWSTT

- Cost prohibitive
- Steep learning curve
- Extensive set up and take down time
- Physically demanding for therapists
- Physically demanding for patients

Advantages of Over Ground BWS

- Studies show body weight support gait training to be effective when performed over ground, not just on the treadmill
- Stepping intensity and variability are important
- Only over ground body weight support improves step length symmetry ratio

Disadvantages of BWSTT

- Doesn’t allow patient to vary pace as they fatigue
- Does not allow a patient to practice turning when on the treadmill
- Difficult to steer when off the treadmill
- May hit ceilings if therapists attempt to use it off the treadmill

Over Ground BWS

- Low cost
- Easy to train and learn
- Less physical demand on the therapist
- Eliminates the need to walk on a treadmill to have unweighted gait

- Patient can stand backwards (reverse position) in the device
- Patient can self-select the amount of unweighing or the speed of walking. However, therapist can override this if needed
- Can go anywhere in a building with wide open hallways
Limitations/Considerations

- Maximum weight (Rifton E-Pacer: 350 lbs.)
- Cannot be used on stairs, uneven or unlevel surfaces, or through narrow doors
- Unstable if a patient strongly pushes posterior or to one side
- If back wheels do not swivel (for stability), then the turning radius is wide
- May be too big to fit into most bathroom areas or to use in most home environments

Use with Caution

- Foley's
- Chest tubes or drains
- Wound vacuums
- Feeding tubes
- Fixed kyphosis
- LVADs
- Supplemental oxygen

Contraindications

- Hip or pelvic fractures
- Weight bearing precautions in any of the four limbs
- Severe flexor tone or contractures
- Wounds around pelvis or trunk
- Patients who are agitated or unable to follow instructions
- Comorbidities
- Patients who lack the ability to tolerate standing for one minute in the E-Pacer should not advance to gait

Over Ground BWS

Rifton TRAM and Rifton E-Pacer

Video: Janette Tazzia, Stroke

Rehabilitation Science

"Neural plasticity is believed to be the basis for both learning in the intact brain and relearning in the damaged brain that occurs through physical rehabilitation."
Motor learning is “a set of internal processes associated with practice or experience, leading to relatively permanent gains in the capability for skilled performance.”

Effective Gait Training Protocol

Intensity of Practice
- Frequency
- Duration
- Rest
- Pace

Technique
- Rhythmic Auditory Stimulation
- How much to unweight?
- Add-ons that may help
- Tracking progress

Frequency and Duration

- Patients may increase distance as they improve endurance
- Continue BWS 3+ weeks until able to ambulate safely with assistive device and minimum assistance
- Leave time for functional goals as well

Rest

- Walk continuously for 3 minutes, then rest. Repeat cycle for 30 min.
- If foot drag is noted or postural control diminishes, provide standing rest break
- Manually maintain knee extension of involved limb and/or cue for upright posture as needed
- Check vitals if a patient is symptomatic

Pace

- Faster is better
- Begin at .7 mph and increase the speed by .1 mph increments
- Increase speed each session until normal gait speed is achieved
- Once normal step length can be maintained, speeds should be increased about 5% per week
- 1.8 mph is most ideal
Pace

1 mile = 5,280 feet
1.8 miles per hour

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Rhythmic Auditory Stimulation

- Music is motivating. Play beat on patient’s weak side to increase attention.
- 120 beats per minute = 1.8 mph. Cue patient to step in time with the beat.
- Music with strong beat or metronome significantly improves cadence, step length, and balance scores on the Dynamic Gait Index, as well as coordination.

How Much to Unweigh?

- Initially 30-40% of patient’s weight reduces BWS as patient improves.
- As BWS is reduced, patient should still be able to maintain knee extension during stance phase.
- Unweighing decreased until harness is only present to prevent falls.

Add-Ons

- Arm support vs. arm swing.
  - Arm support with strap secure weaker arm.
  - Arm prompt with step.
- AFO combined with BWS yields better results.
- Functional e-stim combined with BWS yields better results.

Tracking Progress

- Scale – records unweighing (in lbs.)
- Odometer – records distance (in feet)

Protocol: Before You Start

- Stretch hamstrings and gastrocnemius.
- Use restroom first.
- Clothing: shoes with laces or Velcro, sweatpants or shorts.
- Wheelchair with removable armrests and footrests.
Protocol: E-Pacer Technique

When to Discontinue
- Therapist no longer needs to facilitate
- Harness for safety only
- Tolerates walking for 10 min. without rest break

After BWS, Focus on
- Therex
- Transfers
- Balance
- Over ground gait
- Stairs

After BWS
- Patient may initially require min assist x1, a cane or walker, and an AFO
- May wean off these by 6 months post stroke

Factors in How Well a Patient Will Respond
- How early unweighted gait is initiated
- Level of personal motivation
- Family support
- Age
- Pre-stroke independence/comorbidities
- Stroke severity
- Individual’s body weight/body mass index
References


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