The Benefits of Gait Training

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Learning Objectives

☐ Will be able to identify the definition of gait training, and will be able to identify how it is currently being used in different settings.
☐ Will be able to identify ten diagnoses that could benefit from a gait training routine and how to evaluate a potential candidate.
☐ Will be able to identify and measure physical benefits of patients involved in a gait training routine.

Learning Objectives

☐ Will be able to identify and measure the social benefits involved in a gait training routine.
☐ Will be able to identify and measure the psychological benefits of a gait training routine.
☐ Will be able to identify and compare the different product types and brands that are readily available on the market today, and differentiate between them.
Gait Training

- Gait training refers to helping a patient relearn to walk safely and efficiently. Gait training is usually done by rehabilitation specialists who evaluate the abnormalities in the person’s gait and employ such treatments as strengthening and balance training to improve stability and body perception as these pertain to the patient’s environment.

Assistive Devices Employed

- Parallel bars
- Walkers
- Canes
- Gait Trainers
- Tread Mill
- BWS
- Crutches
- Arm Braces
- Exoskeletons

Settings Practicing Gait Training

- SNF’s
- School Settings
- Home Settings
- Inpatient Rehab Facilities
- Outpatient Rehab Facilities
End Results

- The desired end result is for the patient to have the ability to ambulate safely in all environments with the least amount of assistive technology possible with the end goal of gaining a level of independence they did not previously have.

Applicable Conditions

- Amputation
- Osteoarthritis
- Muscular Dystrophy
- CP
- CVA
- Parkinson’s Disease
- TBI
- SCI
- Post Surgery
- Sports Injury
- Mental Retardation

Physical Benefits

- Decrease in likeliness of developing Osteoporosis
  - Non-Ambulatory patients have a higher propensity to develop Osteoporosis due to the inability to stand independently
  - Weight Bearing in CP and SCI patients has shown to increase bone mineral density in the femur as well as the spine
  - Static movement has shown to be more beneficial than dynamic loading
  - Because it helps strengthen the bones, it also aids in strengthening bones in children and promoting development
Measurement
- Bone density changes can be measured by having a bone density measurement scan done.
- Decrease in bone injuries may also be an indication

Physical Benefits Cont’d
- Improves overall alignment, prevents contractures, decreases spasticity, and improves range of motion.
  - These benefits can also lead to a decrease of pain in the long run
  - Also experience a more trunk, head, and neck control over time
  - Children who are mobile at a young age, have a lower risk of obesity, diabetes, pressure sores and hit milestones at a more normal rate

Measurement
- Modified Ashworth Scale for grading Spasticity
  - Ashworth Scale for grading Spasticity
    - Grade Description
      1) no increase in muscle tone; 2) slight increase giving a catch when part is moved in flexion or extension; 3) more marked increase in tone but only after part is easily flexed; 4) considerable increase in tone; and 5) passive movement is difficult and affected part is rigid in flexion or extension.
    - The Ashworth scale is one of the most widely used methods of measuring spasticity, due to its simplicity and reproducible method.
    - The MAS better measures muscle hypertonia instead of spasticity.
Measurement

- Modified Ashworth Scale for grading Hypertonia
  - Grade Description
    - 0 - No increase in muscle tone
    - 1 - Slight increase in muscle tone, manifested by a catch and release or by minimal resistance at the end of the range of motion when the affected part(s) is moved in flexion or extension
    - 1+ - Slight increase in muscle tone, manifested by a catch, followed by minimal resistance throughout the remainder (less than half) of the ROM
    - 2 - More marked increase in muscle tone through most of the ROM, but affected part(s) easily moved
    - 3 - Considerable increase in muscle tone, passive movement difficult
    - 4 - Affected part(s) rigid in flexion or extension

Measurement

- Pain Tracking via a pain chart
- Increase in trunk, neck, and head control in both therapy, school, home, and social settings measurable by observation as well as ability to complete certain tasks

Physical Benefits Cont’d

- Improvement of internal organ function
  - Based on the spine extension and anterior pelvic tilt, the organs have more room and are less cramped
  - This can improve function in the circulatory system, lungs, bladder, and bowels.
Measurement

- Bladder function improvement can be measured by the number of UTI's experienced
- Lung function can be measured by the amount of physical activity the patient can do as well as O2 levels
- Bowel function can be measured by regularity
- Circulation can be measured by heart function, frequency of pressure ulcers

Physical Benefits cont’d

- Increased Circulation
  - Non-Ambulatory patients have a decrease in blood flow, and will be more likely to have poor circulation as well as lower oxygen levels in their lower extremities
  - Kawashima, Nakazawa, and Akai found that leg movements increased oxygen levels into the muscles of SCI patients
  - Increased circulation, also allows for more alertness and higher brain function.

Measurement

- Circulation can be measured in a variety of different ways, but many are complicated and expensive.
  - A system and method of measuring blood circulation velocity includes the steps of keeping a person measured by a blood oxygen saturation analytical instrument and served by a ventilator; setting an initial time point, providing a first gas to the person via the ventilator, and starting to record a blood oxygen saturation value per predict time interval; providing a second gas to the person at a first time point; stopping recording the blood oxygen saturation value at a terminal time point; setting a reference time point according to the blood oxygen saturation value which has a variation according to the records; obtaining the person's blood circulation velocity, which is proportional to the reciprocal of the difference of the reference time point and the first time point.
For the purposes of measuring gait training effectiveness, it is more realistic to use Oxygen Concentration as a measuring tool. Increased brain function will be apparent with ease of completing tasks that were once difficult. Also, may be more alert to surroundings and environment.

**Physical Benefits Cont’d**

- **Improved Lung Function**
  - By standing in conjunction with movement, not only do the lungs have more space in which to function, but they are also being forced to work. This increases blood flow and increases oxygen concentration throughout the body.

- **Respiratory Function**
  - It was reported in the UK from 1966 to 1991 that 37% of children with CP died as a result of viral or bacterial pneumonia and 27% died as a result of acute upper respiratory illnesses such as bronchitis, bronchiolitis, or as a result of pneumonia due to aspiration of foods, liquids, or secretions. (Gilligan, Hulit-Harrigan, and Sargent, 2012)
Physical Benefits Cont’d

- Improved Lung Function
  - Because of the vertical position, the abdominal muscles. Coupled with gravity pulling down on the ribs. This in turn lengthens muscles allowing them to contract more easily.
  - This allows total lung volume to increase to four times as much as before

Physical Benefits Cont’d

- Increased Lung Function
  - Children with limited movement can also suffer from feeding issues and poor coughing abilities, allowing fluid to develop in their lungs
  - Being upright and mobile can decrease fluid in the lungs as well as coughing

Measurement

- Change in O₂ concentration measured by an Oximeter.
- Change in breathing as measured by an RT, physician, or observation
- The ability to take deeper breaths
- Less Coughing
- Fewer Hospitalizations due to respiratory ailments
Physical Benefits Cont’d

- Increased Bowel and Bladder Function
  - Once again, standing gives these organs more space in which to function properly.
  - Additionally, exercise can trigger these processes.
  - Patients in a standing and/or gait training routine experience more regular bladder and bowel function, but also have less problems, such as UTI’s.

Social Benefits of Gait Training

- Gait Training can allow for children and adults to stand eye to eye with peers.
  - This leads to healthy interaction that would not normally be achieved without the use of assistive technology.
  - This also allows for children to take part in activities that would not normally be possible, including sports.
  - Outdoor gait trainers

Measurement

- By measuring activities, such as baseball, kickball, soccer, etc, it is apparent how gait trainers can increase the opportunity for social interaction. Also, by playing on sports teams, children learn peer cooperation, problem solving, and working together to accomplish a goal.
Social Benefits of Gait Training Cont’d

- Gait Trainers and Walkers can give patients the opportunity to tactiley experience their environment
  - Anterior vs. Posterior gait trainers and walkers
  - Experiencing ones environment utilizing all five senses is crucial for all aspects of development, including socially

Measurement

- The amount of social interaction possible is quite easy to measure with and without AT. Without the use of a gait trainer, two children would be deprived of social interaction, eye to eye contact, and the ability to touch each other. This will lead to increased happiness and a greater quality of life

Case Study #1

- Two patients who had never been able to have social interaction including tactile, while standing
- The Grillo being used in an Anterior fashion coupled with the Kid Walk allowed the two patients to get close enough to each other to communicate, touch, and possibly embrace
- Having a peer or stimuli across the room also motivates patients to ambulate to it. This motivation is increased when they can get close enough to the stimuli to touch or access it.
Psychological Benefits of Gait Training

- Increased Independence
  - In children, ambulation is a milestone that allows for them to separate themselves from their parents and do more independently.
  - In children who's ability to ambulate is impaired or delayed, gait trainers can assist in gaining this independence.
  - In adults, independence is necessary to care for oneself without assistance. This includes after an SCI, CVA or due to a lifelong condition.
  - Gait training can potentially allow an adult to live independently as opposed to having a home health aide or having to reside in a SNF or assisted living setting.
Measurement
- For adults, changes in living situations, amount families have to help with ADL's, or lessening in the frequency and/or time of home health workers
- For children, taking the initiative to do more things independently.
  - This includes less reliance on parents or caregivers to do things for them
  - Child/Parental separation

Psychological Benefits of Gait Training Cont'd
- Increased Confidence
  - By being more self-sufficient, patients who are part of a gait training routine experience more confidence than those who don’t.
  - Independence leads to confidence, which in turn lessens feelings of helplessness, and depression.

Measurement Cont'd
- Depression lessens
- Completing more activities independently
- Less withdrawn
- Appears more confident
- Taking the initiative to be more independent
Psychological Benefits of Gait Training Cont’d

- Awareness of Surroundings & Environment
  - By experiencing their environment at a young age, children have greater cognitive ability and academic performance.
  - While experiencing their environment, children learn how to interact with their environment and how to overcome obstacles.
  - Instead of being an observer, they learn how to be a participant.

Measurement

- Academic Performance
- Problem solving
- More engaging with others
- Increased interaction with their environment
- Being an actor as opposed to being the one watching the movie

Psychological Benefits of Gait Training Cont’d

- Children who are mobile are less apathetic, have more curiosity, and take more initiative in many aspects of their life.
- They are more aware of events and their surroundings.
Measurement

- This can be apparent in observing the changes in a child’s behavior before starting gait training to after. Children may be more attentive, inquisitive, and generally more happy.

Patient Evaluation

- Patients must be evaluated prior to the decision to begin a gait training regimen
  - Things to take into consideration include strength, stability, coordination, and balance
  - Also consider mental and emotional preparedness for gait training
  - Consider how the patient could possibly benefit from a gait training routine
  - What is the final outcome for them. Specifically, what will they be able to do that they could not before

Treatment Progression

- Endurance over time
- Going from more positioning, to less, to no AT at all!!
- Beginning with Standing
  - In treatment
  - Warming up each time
In order to determine the effectiveness of the treatment, there must be measurable data. There are three measurements:

- Impairments (using the ASIA Impairment Scale and motor Scores)
- Activity including ambulation speed, gait characteristics, independent walking, and the Walking Index for Spinal Cord Injury (WISCI)
- Amount of participation

Outcome Measurability Cont’d

- Observational Gait Analysis-can be utilized with videotape
- Gait Mat-A gait analysis system (pressure sensitive mat) for measuring the spatial and temporal parameters of gait.
- Step Activity Monitor-a small, lightweight accelerometer that both counts strides and observes activities.
- Patient/Family/Caregiver Report
- Clinician Observation

Outcome Measurability Cont’d

ASIA Assessment of Neurological Impairment-used to assess the level of spinal cord injury
WISCI II is a 20 item scale with a low score of 0 (meaning the patient is unable to walk) and a high score of 20 meaning the patient can walk with no assistive devices or technology.
Post Assessment

☐ After the assessment is complete and if the determination has been made that Gait Training is the appropriate treatment, it is next necessary to determine the appropriate assistive technology device to use. The aim is to always use the least restrictive AT possible.
Measuring

- A good fit is crucial for patient safety as well as effectiveness of treatment
- Measurements needed
  - Overall height
  - Pelvic circumference
  - Chest circumference
  - Inseam
  - Armpit to floor height
  - Overall weight

Proper Form

- Trunk upright
- Legs straight
- Eyes forward
- Hands at side or in front
Barriers to Overcome
- Physical Setbacks
- Family Obstruction
- Funding Restrictions
  - Denials
  - Request for more info
- Patient Unwillingness
  - Fear
  - Pain
  - Laziness

Additional AT Needed
- Leg Braces
  - Standard Braces
  - RGO (Reciprocating Gait Orthosis)
    - The Reciprocating Gait Orthosis or RGO is the most frequently used brace for the ambulatory needs of a paralyzed child or adult. There are other types of RGO’s presently in use, the dual-cable and horizontal cable produced by Fillauer, Inc. and the multibank and bilateral-leg Fillauer RGO. The Fillauer RGO is superior compared to other devices. Hands-free standing and the use of the orthosis counteracts the tendency for hip contractures. With every step, as one leg flexes, the other leg must extend and thereby stretch out the hip contracting structures. Agile patients can be fitted as early as 18 months of age, giving them a better chance for walking and standing and therefore enjoying earlier the physiological, skeletal and psychological benefits of being upright.

Additional AT needed Cont’d
- Prosthetic Legs
- FES (Functional Electrical Stimulation)
  - is a technique that uses electrical currents to activate nerves innervating extremities affected by paralysis resulting from spinal cord injury (SCI), head injury, stroke and other neurological disorders. FES is primarily used to restore function in people with disabilities. It is sometimes referred to as Neuromuscular Electrical Stimulation (NMES).
Transfer Consideration

- Depending on the environment the equipment will be used, patient transfer must be taken into consideration
  - Therapist/Caregiver transfer
  - Self Transfer
  - Lift options
    - Portable vs. Track System
Demo Trial
- Before prescribing and purchasing a certain unit, it is ideal to first trial several different models. Most manufacturers will supply units for this purpose. Many funding sources require this as well.

Gait Training Funding
- State Medicaid Programs
  - Each state’s program is different and has different requirements to get equipment funded
- Private Insurance
  - Many have the same requirements as Medicaid
- Waiver Programs
- Service Clubs
- Schools
- Private Pay

LMN Writing
- LMN
  - In addition to medical justification, adding things such as quality of life and potential financial benefit to funding may help
  - Contact manufacturers for added information they may be able to provide
  - LMNbuilder.com
Gait Trainer Components

- Chest Support
- Pelvic Support
- Leg Straps/Saddle
- Frame
- Full unit vs. Ordering pieces separately

Gait Trainers Available (Anterior)

- Dynamico (Ormesa)

Gait Trainers Available (Anterior)

- Pony by Snug Seat
Gait Trainers Available (Anterior)
- Comet by Wenzelite

Gait Trainers Available (Anterior)
- Meywalk

Gait Trainers Available (Anterior)
- Bronco by Snug Seat
Gait Trainers Available (Posterior)

- Star by Wenzelite

Gait Trainers Available (Posterior)

- Crocodile by Snugseat

Gait Trainers Available (Posterior)

- Gator by Snugseat
Gait Trainers Available (Posterior)
- Nurmi Neo by Otto Bock

Gait Trainers Available (Posterior)
- Cricket

Gait Trainers Available (Anterior/Posterior)
- Grillo by Ormesa
Gait Trainers Available (Anterior/Posterior)
- Pacer by Rifton

Gait Trainers Available (Anterior/Posterior)
- Luminator by Drive

Gait Trainers Available (Dynamic)
- Kid Walk by Prime Engineering
Gait Trainers Available (Dynamic)
- Walkabout

Are All Gait Trainers the Same?
- Though many are similar, not all fit every patient.
- Proper positioning must be taken into consideration including alignment of the patient’s head, trunk, and lower limbs
- Cost also varies widely

Accessories Available
- Directional Locks
  - Prevents the casters from swiveling. Will keep the unit going in a straight line. Can be used on either the front or the back.
- Drag Brakes
  - Adjustable brakes that require more force for the unit to move.
- Anti-Reverse Wheel Locks
  - Prevents the unit from rolling backwards
- Weight Bars
  - Adds weight to the unit, requiring more force to move it.
Accessories Available

- **Scissor Board**
  - Prevents scissoring or crossing of the legs
- **Communication Tray**
  - Used for patients to do activities while standing
- **Leg Abductors**
  - Used to position and keep legs in optimal position
- **Forearm Supports**
  - Used to support arms
- **Saddle**
  - Used for patients who cannot yet stand
- **Ankle Straps**
  - Used to keep legs in optimal position

Accessories Available

- **Lateral Supports**
  - Used to keep the trunk in an optimal position
- **Back Pad**
  - Used in Posterior Gait Trainers. Used to support the lumbar region of the back
- **Handle Bars**
  - Used in either anterior or posterior units to allow the patient to support themselves with their arms

Important Features

- **Versatility**
- **Ease of use**
- **Growth capabilities**
- **Ease of adjustability (without tools)**
- **Durability**
- **Ability to customize**
Outdoor Vs. Indoor

- Indoor is ideal for maneuvering in tight spots
  - Smaller wheels that swivel
- Outdoor is ideal for sports
  - Baseball, Soccer, kickball, etc.
  - Larger, outdoor tires that are directionally locked

Posterior Vs. Anterior

- Posterior is typically for patients who need less support
  - Rear Facing
  - Many times do not have chest support, pelvic support or accessories that are required for advanced positioning
  - Posterior allows the patient to get closer to objects or people
  - Most have a pad that fits in the lumbar region for comfort and support
  - Usually the patient is supported by their arms as well as their legs

Posterior Vs. Anterior cont’d

- Anterior is usually used for patients who require more positioning and support
  - Forward facing
  - Usually with pelvic support, chest support, and other positioning items
  - Usually cannot get as close to items
  - Transition from Anterior to Posterior
New Kinds of Technology

- **Exoskeletons**
  - Similar in appearance to leg braces, but actual use FES technology to reteach the brain how to walk.
  - Newer technology that allows spinal cord injury patients to actually walk without the assistance of others.
  - They are expensive, and at this point are primarily only being purchased by select rehab or SCI units.
  - Intended for injuries around T10 or lower

New Kinds of Technology Cont’d

- **Exoskeletons Cont’d**
  - “It uses onboard embedded microprocessors and sensors to determine the user's current state and intentions, and provides joint torques at the hips and knees to generate motion.” (Mobility Management February, 2013)
  - Referring to the Vanderbilt exoskeleton

New Kinds of Technology Cont’d

- **Exoskeletons Cont’d**
  - Though the premise of exoskeletons are the same, many work a little differently
  - They are getting more complex and lighter as time goes on
Constantly Evolving Products

- Just like other products in the industry, new Gait Trainers are constantly being created and old ones improved.
Clinical Case

Age: 4 years  height: 98 cm  weight: 12kg

Diagnosis: PCI (spastic tetraplegia)

TEST: GRILLO con OneTwo, version Posterior PA

We easily adjust Grillo to accommodate her conditions, maintaining the same barycentre line.

C. walks helped by her mother.

During the tests, the configuration of the walker has gradually changed, inserting:

- Arm rests with taken and perpendicular handheld, to promote the OPENING OF HER HANDS and correct the ulnar deviation, placing the right arm rest higher than the left one (because her right body side is more compromised than the left one).
- The anti-reverse wheel stops (A) (she hasn't a good head control).
- The directional locks on the anterior wheels (D).

About the pelvis and the pelvic support

Grillo assures a correct up-right posture thanks to its good “pelvic support” (as the mother’s hands). This allows the child to free her hands for exploration and manipulation functions REACHING INDEPENDENCE!
Clinical Case

Age: 10 years  height: 133cm  weight: 34kg
Diagnosis: Cerebral Palsy
TEST: GRILLO size OneTwo, version Anterior PT

The HANDLEBAR GIVES A FRONT REFERENCE and permits to maintain the horizontal eyeball during walking.

Clinical Case

Age: 8 years  height: 135cm  weight: 35kg
Diagnosis: Cerebral Palsy, Tetraparesis
TEST: GRILLO size OneTwo, version Anterior PT

In this way the upper limbs are relaxed.

Light adductive effect WITHOUT PRESSURE !!!

head, trunk and lower limbs are correctly aligned
Clinical Case

**Name:** F.  
**Age:** 8 years  
**Diagnosis:** CPI, paresis of lower limbs

1° evaluation Grillo Posterior SA with lumbar support, folding seat and arm supports.  
2° evaluation Grillo Posterior PA with pelvic support, folding seat and arm supports.

**RESULTS:** Using Grillo Posterior PA the child has a correct alignment between head, trunk and lower limbs and the pelvis is more stable.

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Clinical Case

**Name:** E.  
**Age:** 9 years  
**Diagnosis:** Tetraparesis with a partial head control

1° evaluation Grillo Posterior P with pelvic support and handles.  
2° evaluation Grillo Posterior PT with pelvic support and trunk supports.

**RESULTS:** The 2° version improves the alignment between trunk and head.