KEEP MOVING: UTILIZING A MOVEMENT SYSTEM APPROACH TO HELP THOSE WITH DOWN SYNDROME STAY ACTIVE AND HEALTHY

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Children's Hospital of Philadelphia®

DSMIG-USA® Down Syndrome Medical Interest Group

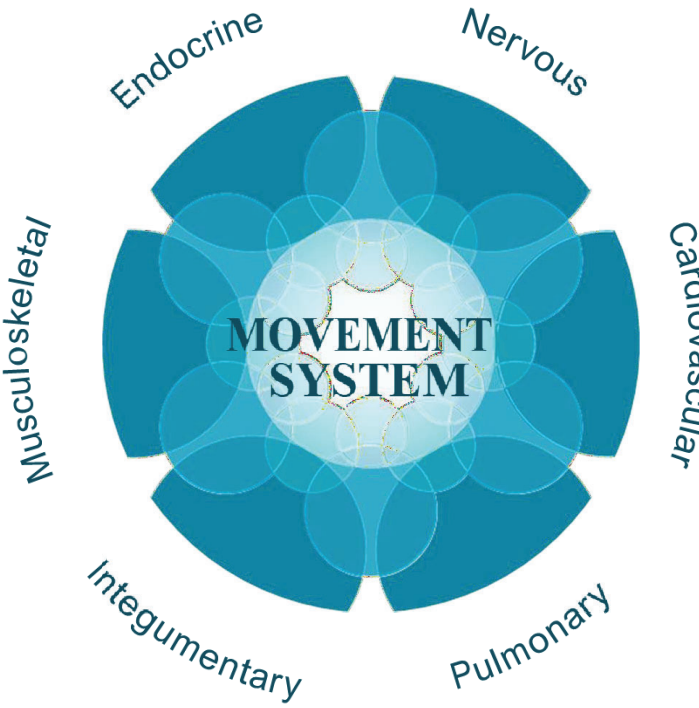
NO DISCLOSURES

A LITTLE BIT ABOUT US …

OBJECTIVES:

BY THE END OF TODAY'S SESSION, THE LEARNER WILL:

- LO1: UNDERSTAND HOW PHYSICAL THERAPISTS CAN HELP THOSE WITH DOWN SYNDROME STAY ACTIVE AND HEALTHY UTILIZING A MOVEMENT SYSTEM APPROACH
- LO2: UNDERSTAND THE CONSTRUCTS OF THE MOVEMENT SYSTEM.
- LO2: APPLY A MOVEMENT ANALYSIS TO THE TASK OF STAIR CLIMBING
- LO4: APPLY THE MOVEMENT SYSTEM FRAMEWORK TO LEARNING TO WALK AND HIKING



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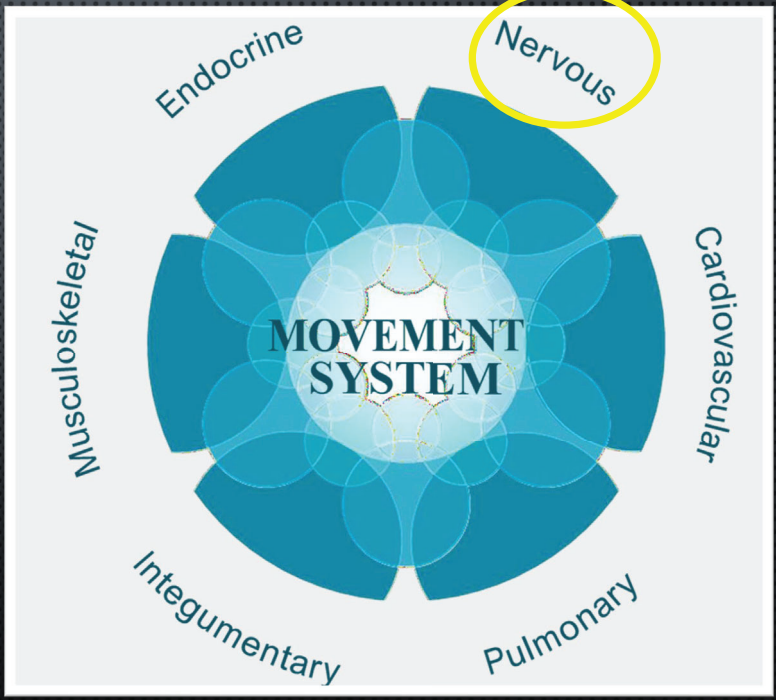
CASE 1: 7-YEAR-OLD WITH DS

- How would you describe her speed walking up and down the stairs?
- How would you describe the smoothness/modulation of how she walks down the stairs
- Is she independent?
- Is PT indicated?
- Do you think she can keep up with her peers at school?

NERVOUS SYSTEM: CNS COMPONENTS

- Tone
- Fluency
- Coordination
- Sensory perception
- Processing
- Neurobehavioral
- Neuromodulators



TONE

- The brain's control of resistance to gravity
- Constant low level of discharge of excitatory innervation
  - Vs Rhythmic contractions
- On clinical exam: resistance to passive movement
- Vestibular system working to maintain upright posture
  - Semicircular canals (temporal bone): angular acceleration detection
  - Otolith system: Linear acceleration
- Complex other systems: cerebellar, limbic-hypothalamus, basal ganglia, cerebral cortex, reticulospinal, brainstem

MODULATION

- Balance of excitatory and inhibitory neurons
- Networks: groups of neurons that work together
- Rhythmic: pacemaker (e.g. breathing) vs. when neurons reciprocally inhibit each other
- Rhythmic motor behavior is essential element of early motor development (one small study suggests DS delayed)
- Central pattern generating networks (e.g. walking)
- Ongoing interplay between intrinsic properties of neurons in the network, time dependent properties and strength of the synapses among networks.

COORDINATION AND MOTOR PLANNING

- Multiple networks working together to process complex array of purposeful movements
- Apraxia, dyspraxia (coordination of movement: e.g. speech, jumping jacks, swimming)
- Difficulty with multi component motor activities (e.g. getting dressed, riding a bike).
- Responsive to task analysis, practice

SENSORY INPUTS AND FEEDBACK

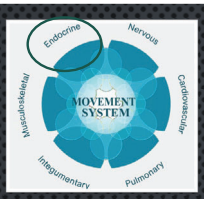
- VESTIBULAR
- PROPRIOCEPTION
- TACTILE
- VISUAL
  - VISUAL ACUITY
  - DEPTH PERCEPTION
  - CORTICAL VISUAL IMPAIRMENT
- AUDITORY
- ENTEROCEPTION (KNOWING WHAT'S HAPPENING IN YOUR BODY)

PROCESSING

- ATTENTION: SUSTAIN, FOCUS, (INHIBIT DISTRACTORS), OVER FOCUS, SHIFT
- PROCESSING SPEED
- LEVEL OF COMPLEXITY OF REQUIRED TASK
- NOVELTY OF TASK

NEUROBEHAVIORAL

- Level of arousal
- Motivation
- Personal preferences
- Previous experiences
- Anxiety
- Pain
- Self direction, vs. Oppositional
- Sensory integration: Seeking, aversions



ENDOCRINE: HORMONAL NEUROMODULATORS

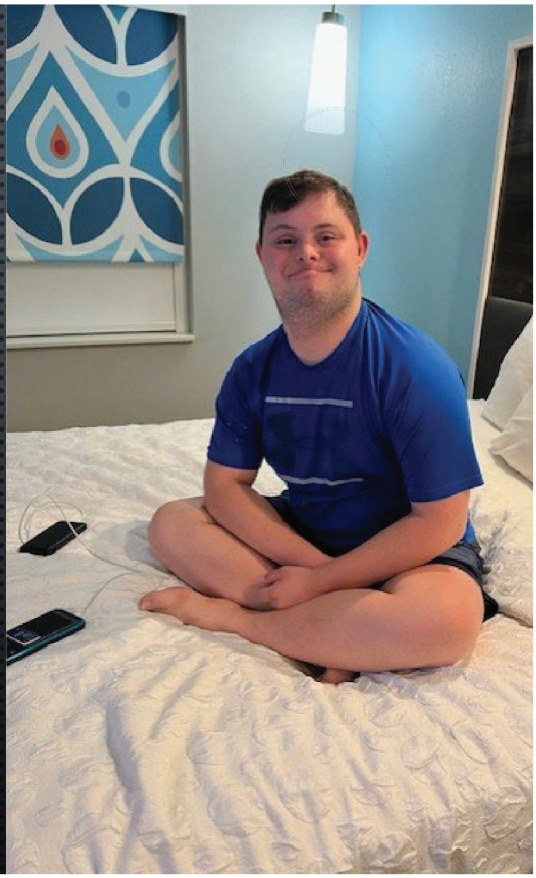
- Neurotransmitters
- Neuropeptides (e.g. orexin)
- Hormones (e.g. leptin, ghrelin, insulin)

MUSCULOSKELETAL

- Posture and Alignment
- Laxity
  - Usually hyperlaxity, hamstring tightness
- Strength
  - Weakness: core, shoulder girdle, hands, imbalance
- Fitness (strength and endurance)
- Pain

CARDIOVASCULAR/PULMONARY

- ENERGY
- ENDURANCE
- SLEEP
- BREATHING MECHANICS
  (LOW LEVEL OF DIAPHRAGMATIC BREATHING)



INTEGUMENTARY

- SENSORY NERVE ENDINGS:
  - TEMPERATURE (AMBIENT AND TACTILE)
  - PAIN
  - PRESSURE
  - STRETCH, (ESPECIALLY AROUND JOINTS) HELPS WITH PROPRIOCEPTION
  - TACTILE (SOURCE OF SENSORY AVERSIONS)
- MOISTURE MAINTENANCE (LEADING TO DEHYDRATION)
- TEMPERATURE CONTROL (SWEAT, AND BLOOD MOVEMENT)
- VITAMIN D WITH EXPOSURE TO SUNLIGHT

HUMAN MOVEMENT:

Task

Environment

Individual

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MOVEMENT SYSTEMS APPROACH IS ABOUT IMPROVING OUTCOMES TO OPTIMIZE FUNCTION

Diagnosis

Treatment

Research

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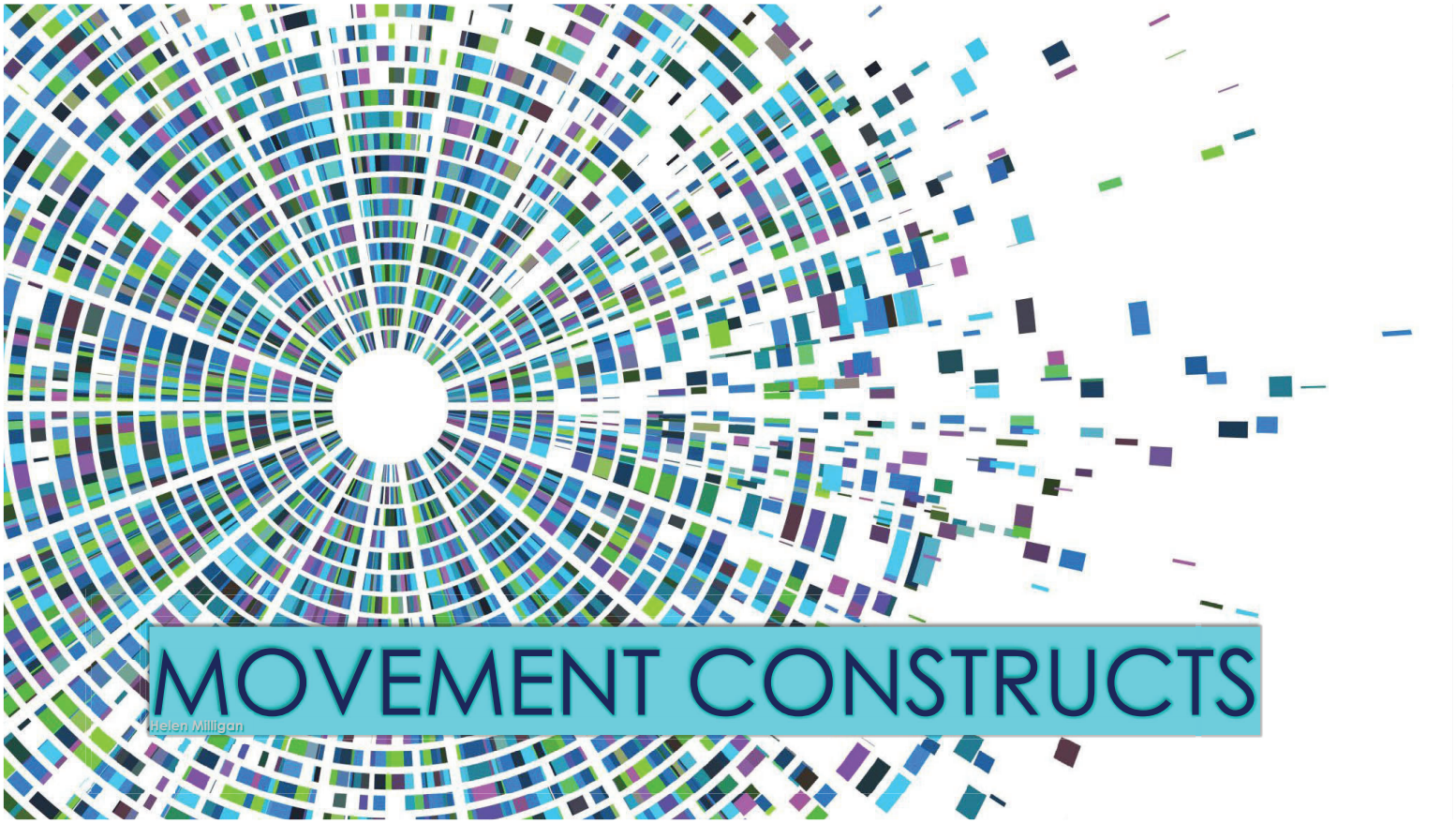

MOVEMENT CONSTRUCTS

Symmetry	Speed	Amplitude
Alignment	Postural control	Coordination

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Which Constructs do most of our patients have Challenges?

- Learning new movements
- Participating in everyday activities: stairs, walking, school taksks, employment tasks.

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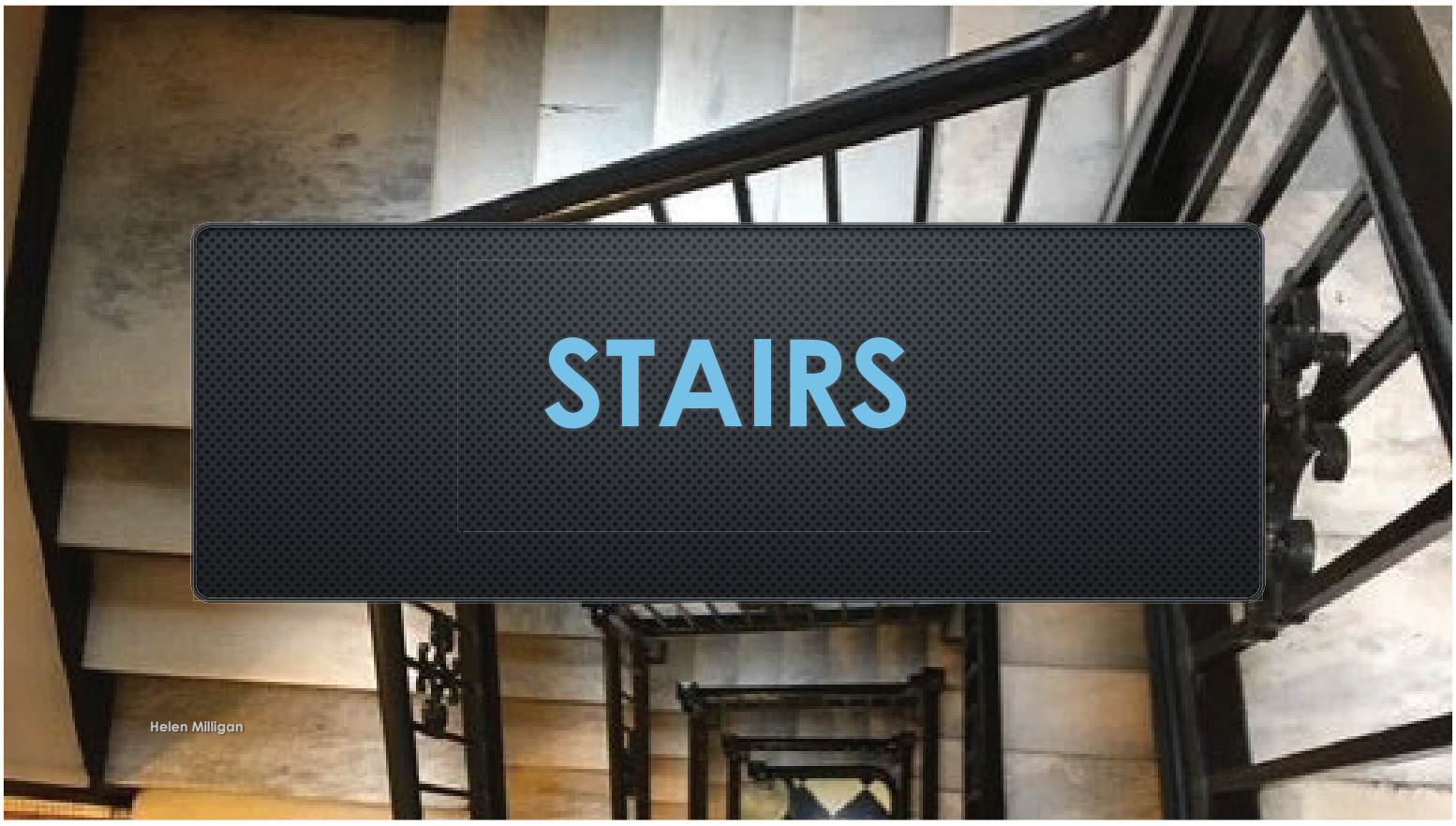
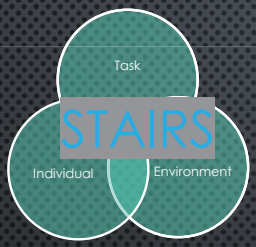


APPLICATION:



Symmetry	Speed	Amplitude
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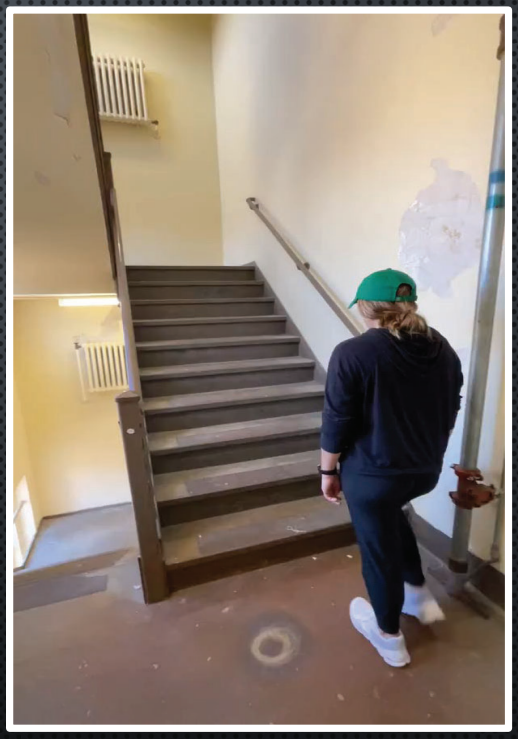

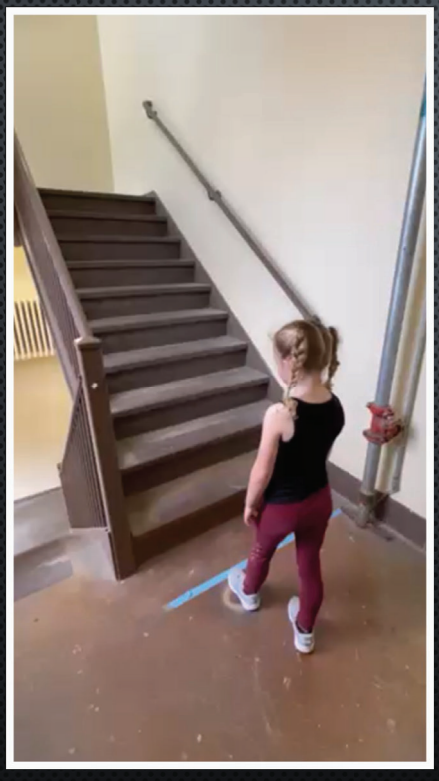

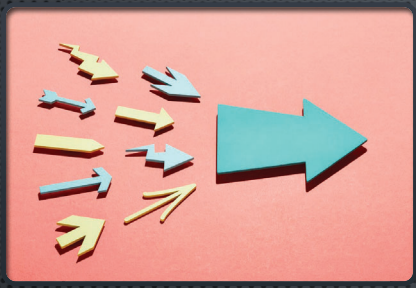

PT IS INDICATED!!!!

GOAL OF PT: IMPROVE HER INITIAL CONTACT WITH KNEE EXTENSION

- LANDS ON A HYPEREXTENDED KNEE
- OVER TIME SHE MAY EXPERIENCE KNEE PAIN DUE TO REPETITIVE STRESS AT THE KNEE
- PT CAN MAKE THIS BETTER!!!!

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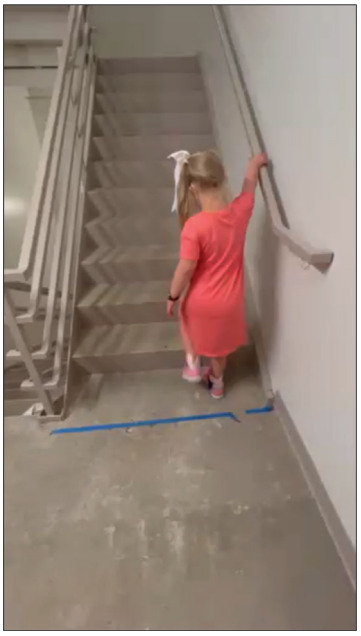

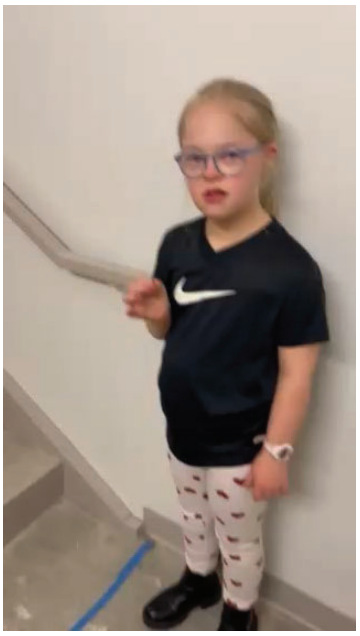

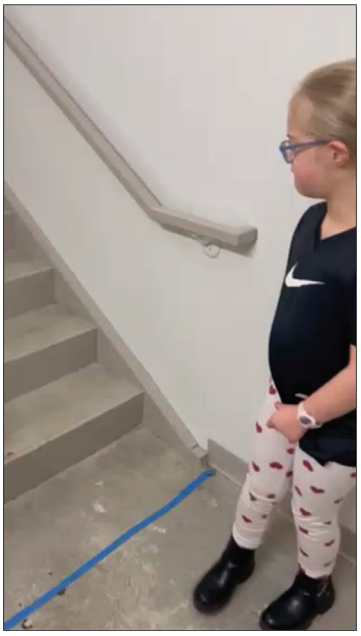

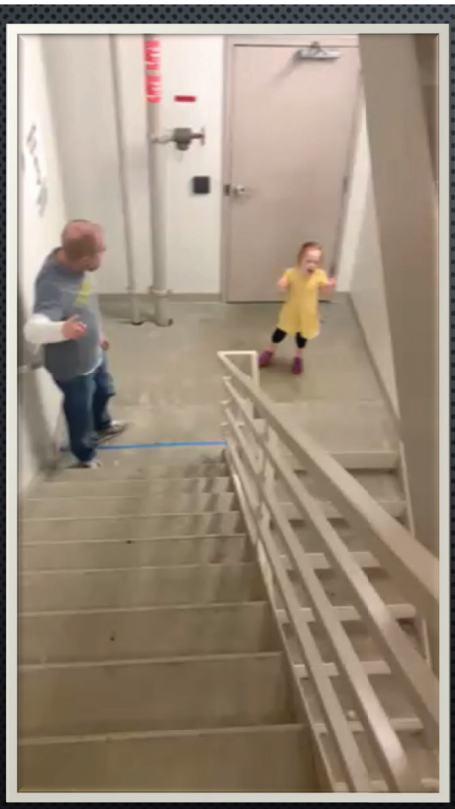

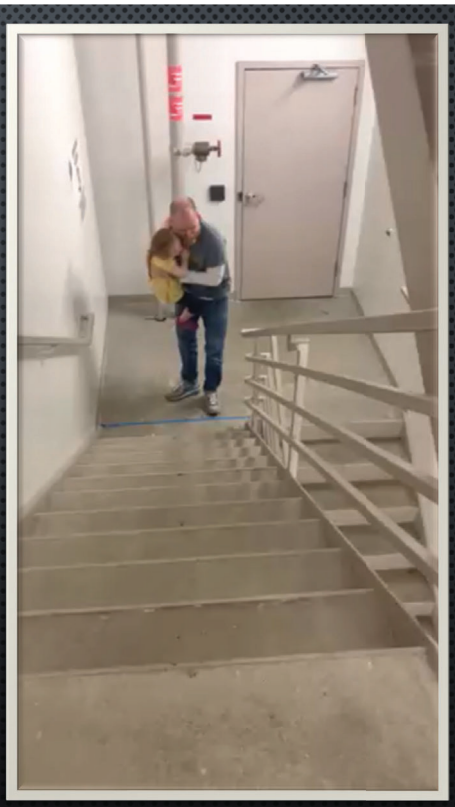

CASE 1:

- 24-month-old Not yet walking:
  - She is currently being kept in the infant room at daycare because she is not walking
  - She is sitting independently, pulling to stand and commando crawling.
  - She does not like to walk with a push toy
  - Parents are eager to have her start walking so that she can be moved to the daycare classroom with other toddlers her age.
  - What would you consider for her?

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TREADMILL TRAINING TO HELP CHILDREN WITH DOWN SYNDROME LEARN TO WALK

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- 2. Ulrich DA, Lloyd MC, Effects of intensity of treadmill training On developmental outcomes and stepping in infants with Down syndrome: Physical Therapy. 2008; 88:114-122.
- 3. Looper J, Ulrich D, Effects of Treadmill Training and supramalleolar orthotics use on skill development in infants with Down syndrome: A randomized Clinical Trial: Physical Therapy. 2010:382-390.

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CASE 2:

- 2-YEAR-OLD NOT YET WALKING

CONSIDERATIONS

WALKING SUPPORTS

Shoes & orthotics

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CASE 3:

18-YEAR-OLD WHO STOPPED IN THE MIDDLE OF WALKS/HIKES WITH HIS FAMILY.

WHAT SYSTEMS COULD BE IMPAIRED?

WHAT CONSTRUCTS WOULD WE BE CONSIDERING?

LET'S USE A MOVEMENT SYSTEMS APPROACH!

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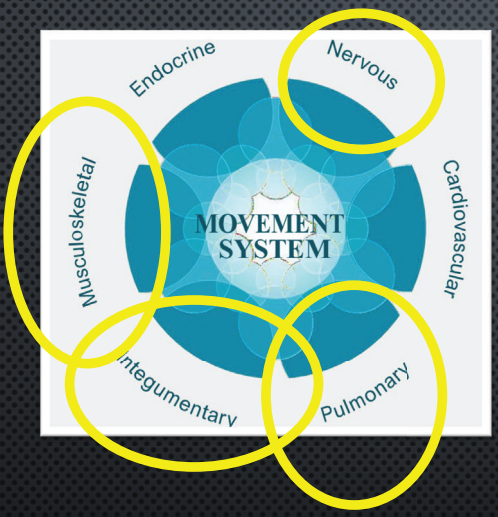

Symmetry	Speed	Amplitude
Alignment	Postural control	Coordination

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ORTHOTICS/SHOES:

Considerations:
Height
Weight
Amount of Hypermobility /ROM
Gait

Early Walkers:

Improve stability and facilitate early mobility

SMO's

Inserts

School age walkers:

Inserts with a sneaker

Older Walkers:

Inserts

Tie sneakers

Improve efficiency

Improve comfort pain

Balance

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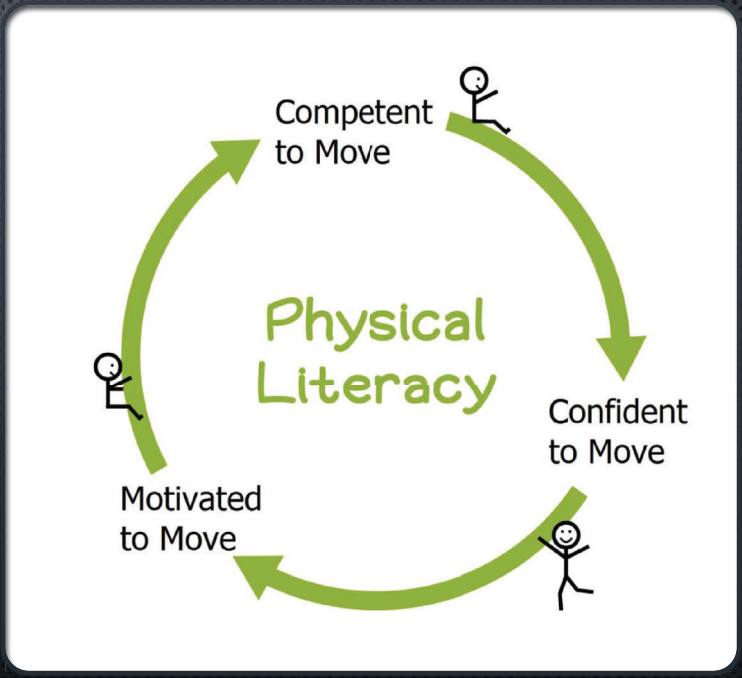
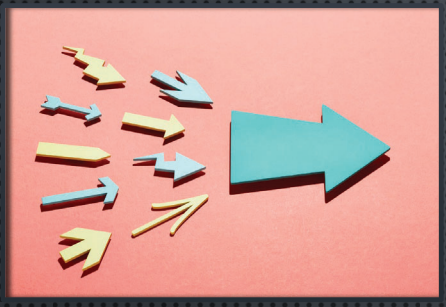
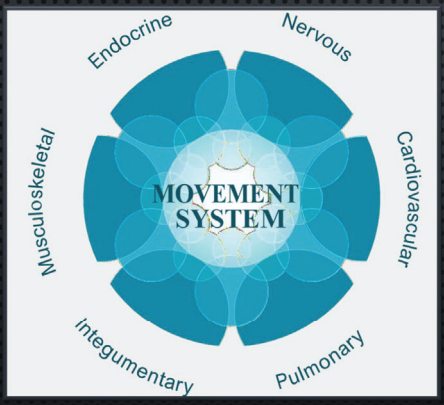
PHYSICAL LITERACY:

- THE ABILITY TO MOVE WITH COMPETENCE AND CONFIDENCE IN A WIDE VARIETY OF PHYSICAL ACTIVITIES IN MULTIPLE ENVIRONMENTS.
- A CONCEPT THAT CELEBRATES EACH INDIVIDUAL'S STRENGTHS AND USES THEM AS A FOUNDATION FOR LEARNING TO LIVE MEANINGFUL AND HEALTHY LIVES THROUGH PHYSICAL ACTIVITY, SPORT, RECREATION, AND LEISURE.







WRAP UP: REFER TO PT! THEY ARE MOVEMENT SYSTEM EXPERTS!

- THE MOVEMENT SYSTEM APPROACH LOOKS AT THE INDIVIDUAL, THE TASK, AND THE ENVIRONMENT.
- THE MOVEMENT SYSTEM ACCOUNTS FOR ALL THE SYSTEMS OF THE BODY AND HOW THEY IMPACT MOVEMENT.
- INDIVIDUALS WITH DOWN SYNDROME HAVE IMPAIRMENTS IN ALL OF THE SYSTEMS OF THE BODY WHICH HELP THEM MOVE.
- MOVEMENT IS COMPLEX: IT'S NOT AS SIMPLE AS LOW TONE OR STRENGTH!
- MISSION OF PHYSICAL THERAPISTS : TRANSFORM SOCIETY BY OPTIMIZING MOVEMENT TO IMPROVE THE HUMAN EXPERIENCE
- OUR PATIENTS BENEFIT FROM PHYSICAL THERAPY TO HELP THEM IMPROVE MOVEMENTS, NOT JUST LEARNING TO CRAWL AND WALK AND NOT JUST ACCESSING THE SCHOOL ENVIRONMENT BUT ALL THROUGHOUT THEIR LIVES.
- PHYSICAL LITERACY IS LEARNING NEW SKILLS ALL THROUGHOUT ONE'S LIFE.

LET'S GET MOVING!

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Thank you!
Aidan Milligan and all those who allowed us to share their pictures and videos.

Christine Tyrell, PT, DPT, PhD

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