**Title and Focus of Activity**: Technology in Rehabilitation: In-Class Active Learning Activity

*Intervention; Management of Care*

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**Course Information:** Neuromuscular Physical Therapy II; 4 credits; Spring of second year. This course occurs after neuroscience, therapeutic exercise, pathophysiology, critical inquiry I, neuromuscular physical therapy I, and one full time clinical rotation. This course occurs concurrently with critical inquiry II and prosthetics and orthotics.

**Learning Activity Description:**

Purpose: To provide students with an instructor-guided experience in which they research, discuss, debate, and apply knowledge about various rehabilitation technologies to a patient scenario.

This activity has three parts, and unfolds in order, over a 3 hour class period.

**Part 1:**

1. The class is divided into 4 groups and assigned one of the 4 following topics:
	1. Body weight supported treadmill training
	2. Lokomat (Hocoma)
	3. Stim Bike (Restorative Therapies)
	4. Vector Gait System (Bioness)
2. Each group then has 45-60 minutes to work as a team to answer the following list of questions, to the best of their ability, with the use of their internet-ready devices to access the library's resources and search engines, as well as traditional internet searches:
	1. What is it?
	2. What does it offer you beyond traditional PT equipment (your hands, your environment, rehab aides, braces, assistive devices, gait belts, weights, etc.)
	3. What are its shortcomings compared with traditional PT equipment?
	4. What impairments might it address?
	5. What functional limitations might it address?
	6. What activity/participation limitations might it address?
	7. How is it similar to walking? How is it different than walking?
	8. What are the indications?
	9. What are the precautions and/or contraindications?
	10. What is the cost to purchase it? What is the cost to implement it?
	11. What evidence supports its use?
3. Groups may work as a team, or split up the questions amongst themselves and share their findings with each other before the end of Part I.

**Part 2:**One or more group members are elected to share their found information verbally, and/or via iPad take-over of the main class computer so that the rest of the class can gain from their research. All information presented during this aspect of the class is testable on midterm and/or final exams, but is not graded in any other way. Student groups are given no more than 10 minutes each for their presentations, including questions, totaling 30-45 minutes of class time.

**Part 3:**Student groups are reshuffled such that groups of 5-6 are created. These new and smaller groups are specifically created such that each group has 2-3 members from one of the initial 4 technology groups, and 2-3 members of another of the 4 initial technology groups. Then, the following patient cases are assigned accordingly. Sixty to 90 minutes are allotted for this part of the class.

Power point slides are concurrently posted with the following student instructions:

* Read your assigned patient case scenario.
* Work as a group to review the details of your assigned case and compare it to the research you have done with your individually assigned devices from part 1.
* Take some extra time to re-review the literature with respect to your specific patient.
* Discuss/debate your thoughts as a group and come up with a recommendation for equipment use to your clinical instructor that is based on sound clinical rationale and best evidence available to support your decision.
* Each group is responsible for turning in ONE paper before leaving class today. This will be 5% of your grade. The whole group will receive the same grade.

# In-Class Assignments

#  GROUP # 1 and 4 - Paraplegia Technology Assignment

Consider the following scenario:

You are a student physical therapist working in the outpatient clinic of a major metropolitan rehabilitation center. Your patient presents 6 weeks post injury as follows:

* Script reads: “Eval and treat - Gait dysfunction secondary to incomplete paraplegia (T10 AIS C)”
* Patient goal: “To walk better, and get rid of this wheelchair.”
* Overall ambulation status: Max A x 2 overall for anterior-lateral weight shift, foot placement, knee and hip stability in stance, for limb advancement, and for complete clearance during swing without assistive device or bracing at the ankle; Max verbal and tactile cues throughout for appropriate alignment, muscle activation, and sequencing; Distance limited to 50’ due to reports of respiratory fatigue and loss of gait quality
* Independent with sit <-> supine, Independent with squat-pivot transfers, Min-mod A for sit <-> stand with HEAVY reliance on UE via standard walker
* ROM and muscle tests: BUE Not fully assessed but appear to be unimpaired; RLE PROM: hamstring length limited to 60°, ankle DF limited to -2°; RLE strength: Hip flexors, extensors, and abductors 1+/5, knee flexors 1+/5, ankle DF 0/5, otherwise not fully assessed due to evidence of abnormal muscle tone; LLE PROM: hamstring length limited to 50°, ankle DF limited to 0°; LLE strength: Hip flexors 2/5, hip extensors and abductors 2/5, knee flexors 2-/5, ankle DF 0/5, otherwise not fully assessed due to evidence of abnormal muscle tone
* Modified Ashworth bilaterally: 3 for hip adductors, 1+ for knee extensors, 10 beats of clonus in with rapid stretch into dorsiflexion
* Absent light touch sensation and proprioception on gross screen of LLE; to be fully assessed
* No immediate evidence of safety or cognitive deficits

At your disposal, you have a body weight supported treadmill training system, and the Bioness Vector, as well as all the traditional physical therapy equipment one might use to address ambulation (rehabilitation support staff, braces, assistive devices, gait belts, etc.) Your CI says, “Both the body weight supported ambulation and the Bioness Vector might be appropriate for this patient. But, they are in high demand so we have to choose only one to start with, and I have to convince the rehab director that this patient should get a spot. What do you want me to recommend?”

# GROUP # 2 and 3 - Tetraplegia Technology Assignment

Consider the following scenario:

You are a student physical therapist working in the outpatient clinic of a major metropolitan rehabilitation center. Your patient presents 8 weeks post injury as follows:

* Script reads: “Eval and treat - Gait dysfunction secondary to incomplete tetraplegia (C6 AIS C)”
* Patient goal: “To walk better, and get rid of this walker.”
* Overall ambulation status: Mod A x 2 overall for anterior-lateral weight shift, knee stability in stance, and for complete clearance during swing without assistive device or bracing at the ankle; Mod verbal and tactile cues throughout for appropriate alignment, muscle activation, and sequencing; Distance limited to 100’ due to reports of muscle fatigue and loss of gait quality
* Min A with sit <-> supine, and CGA sit <-> stand and stand-pivot transfers with walker
* ROM and muscle tests: BUE Not fully assessed; RLE PROM: hamstring length limited to 60°, ankle DF limited to -2°; RLE strength: Hip flexors, extensors, and abductors 2+/5, knee flexors 3/5, ankle DF 1+/5, otherwise not fully assessed due to evidence of abnormal muscle tone; LLE PROM: hamstring length limited to 50°, ankle DF limited to 0°; LLE strength: Hip flexors 3/5, hip extensors and abductors 4/5, knee flexors 3-/5, ankle DF 1/5, otherwise not fully assessed due to evidence of abnormal muscle tone
* Modified Ashworth bilaterally: 3 for hip adductors, 2 for knee extensors, 10 beats of clonus in with rapid stretch into dorsiflexion
* Inconsistent deficits in light touch sensation and proprioception on gross screen of LLE; to be fully assessed
* No immediate evidence of safety or cognitive deficits

At your disposal, you have a body weight supported treadmill training system, and stim bike, as well as all the traditional physical therapy equipment one might use to address ambulation (rehabilitation support staff, braces, assistive devices, gait belts, etc.) Your CI says, “Both the body weight supported ambulation and the stim bike might be appropriate for this patient. But, they are in high demand so we have to choose only one to start with, and I have to convince the rehab director that this patient should get a spot. What do you want me to recommend?”

# GROUP # 5 and 6 - Stroke Technology Assignment

Consider the following scenario:

You are a student physical therapist working in the outpatient clinic of a major metropolitan rehabilitation center. Your patient presents 5 weeks post stroke as follows:

* Script reads: “Eval and treat - Gait dysfunction secondary to R MCA CVA”
* Patient goal: “To walk better, and get rid of this quad cane.”
* Overall ambulation status: Mod A overall for anterior-lateral weight shift, knee stability in stance, and for complete clearance during swing without assistive device or bracing at the ankle; Mod verbal and tactile cues throughout for appropriate alignment, muscle activation, and sequencing; Distance limited to 125’ due to reports of muscle fatigue and loss of gait quality
* Independent with sit <-> supine, and sit <-> stand and stand-pivot transfers with quad cane
* ROM and muscle tests: BUE Not fully assessed; RLE PROM WNL and 5/5 strength throughout all major muscle groups; LLE PROM: hamstring length limited to 50°, ankle DF limited to 0°; LLE strength: Hip flexors 3/5, hip extensors and abductors 4/5, knee flexors 3-/5, ankle DF 1/5, otherwise not fully assessed due to evidence of abnormal muscle tone
* Modified Ashworth: 2 for hip adductors, 2 for knee extensors, 8 beats of clonus in with rapid stretch into dorsiflexion
* Inconsistent deficits in light touch sensation and proprioception on gross screen of LLE; to be fully assessed
* No immediate evidence of impulsivity, neglect, speech, or cognitive deficits

At your disposal, you have a body weight supported treadmill training system, and the Lokomat, as well as all the traditional physical therapy equipment one might use to address ambulation (rehabilitation support staff, braces, assistive devices, gait belts, etc.) Your CI says, “Both the body weight supported ambulation and the Lokomat might be appropriate for this patient. But, they are in high demand so we have to choose only one to start with, and I have to convince the rehab director that this patient should get a spot. What do you want me to recommend?”

# GROUP # 7 and 8 - Stroke Technology Assignment

Consider the following scenario:

You are a student physical therapist working in the outpatient clinic of a major metropolitan rehabilitation center. Your patient presents 5 weeks post stroke as follows:

* Script reads: “Eval and treat - Gait dysfunction secondary to R MCA CVA”
* Patient goal: “To walk better, and get rid of this quad cane.”
* Overall ambulation status: Mod A overall for anterior-lateral weight shift, knee stability in stance, and for complete clearance during swing without assistive device or bracing at the ankle; Mod verbal and tactile cues throughout for appropriate alignment, muscle activation, and sequencing; Distance limited to 125’ due to reports of muscle fatigue and loss of gait quality
* Independent with sit <-> supine, and sit <-> stand and stand-pivot transfers with quad cane
* ROM and muscle tests: BUE Not fully assessed; RLE PROM WNL and 5/5 strength throughout all major muscle groups; LLE PROM: hamstring length limited to 50°, ankle DF limited to 0°; LLE strength: Hip flexors 3/5, hip extensors and abductors 4/5, knee flexors 3-/5, ankle DF 1/5, otherwise not fully assessed due to evidence of abnormal muscle tone
* Modified Ashworth: 2 for hip adductors, 2 for knee extensors, 8 beats of clonus in with rapid stretch into dorsiflexion
* Inconsistent deficits in light touch sensation and proprioception on gross screen of LLE; to be fully assessed
* No immediate evidence of impulsivity, neglect, speech, or cognitive deficits

At your disposal, you have the Bioness Vector, and the Lokomat, as well as all the traditional physical therapy equipment one might use to address ambulation (rehab aides, braces, assistive devices, gait belts, etc.) Your CI says, “Both the Bioness Vector and the Lokomat might be appropriate for this patient. But, they are in high demand so we have to choose only one to start with, and I have to convince the rehab director that this patient should get a spot. What do you want me to recommend?”

# GROUP # 9 and 10 - Tetraplegia Technology Assignment

Consider the following scenario:

You are a student physical therapist working in the outpatient clinic of a major metropolitan rehabilitation center. Your patient presents 8 weeks post injury as follows:

* Script reads: “Eval and treat - Gait dysfunction secondary to incomplete tetraplegia”
* Patient goal: “To walk better, and get rid of this walker.”
* Overall ambulation status: Mod A x 2 overall for anterior-lateral weight shift, knee stability in stance, and for complete clearance during swing without assistive device or bracing at the ankle; Mod verbal and tactile cues throughout for appropriate alignment, muscle activation, and sequencing; Distance limited to 100’ due to reports of muscle fatigue and loss of gait quality
* Min A with sit <-> supine, and CGA sit <-> stand and stand-pivot transfers with walker
* ROM and muscle tests: BUE Not fully assessed; RLE PROM: hamstring length limited to 60°, ankle DF limited to -2°; RLE strength: Hip flexors, extensors, and abductors 2+/5, knee flexors 3/5, ankle DF 1+/5, otherwise not fully assessed due to evidence of abnormal muscle tone; LLE PROM: hamstring length limited to 50°, ankle DF limited to 0°; LLE strength: Hip flexors 3/5, hip extensors and abductors 4/5, knee flexors 3-/5, ankle DF 1/5, otherwise not fully assessed due to evidence of abnormal muscle tone
* Modified Ashworth bilaterally: 3 for hip adductors, 2 for knee extensors, 10 beats of clonus in with rapid stretch into dorsiflexion
* Inconsistent deficits in light touch sensation and proprioception on gross screen of LLE; to be fully assessed
* No immediate evidence of safety or cognitive deficits

At your disposal, you have the Lokomat, and stim bike, as well as all the traditional physical therapy equipment one might use to address ambulation (rehab aides, braces, assistive devices, gait belts, etc.) Your CI says, “Both the Lokomat and the stim bike might be appropriate for this patient. But, they are in high demand so we have to choose only one to start with, and I have to convince the rehab director that this patient should get a spot. What do you want me to recommend?”

# GROUP # 11 - Paraplegia Technology Assignment

Consider the following scenario:

You are a student physical therapist working in the outpatient clinic of a major metropolitan rehabilitation center. Your patient presents 6 weeks post injury as follows:

* Script reads: “Eval and treat - Gait dysfunction secondary to incomplete paraplegia”
* Patient goal: “To walk better, and get rid of this wheelchair.”
* Overall ambulation status: Max A x 2 overall for anterior-lateral weight shift, foot placement, knee and hip stability in stance, for limb advancement, and for complete clearance during swing without assistive device or bracing at the ankle; Max verbal and tactile cues throughout for appropriate alignment, muscle activation, and sequencing; Distance limited to 50’ due to reports of respiratory fatigue and loss of gait quality
* Independent with sit <-> supine, Independent with squat-pivot transfers, Min-mod A for sit <-> stand with HEAVY reliance on UE via standard walker
* ROM and muscle tests: BUE Not fully assessed but appear WNL; RLE PROM: hamstring length limited to 60°, ankle DF limited to -2°; RLE strength: Hip flexors, extensors, and abductors 1+/5, knee flexors 1+/5, ankle DF 0/5, otherwise not fully assessed due to evidence of abnormal muscle tone; LLE PROM: hamstring length limited to 50°, ankle DF limited to 0°; LLE strength: Hip flexors 2/5, hip extensors and abductors 2/5, knee flexors 2-/5, ankle DF 0/5, otherwise not fully assessed due to evidence of abnormal muscle tone
* Modified Ashworth bilaterally: 3 for hip adductors, 1+ for knee extensors, 10 beats of clonus in with rapid stretch into dorsiflexion
* Absent light touch sensation and proprioception on gross screen of LLE; to be fully assessed
* No immediate evidence of safety or cognitive deficits

At your disposal, you have the stim bike and the Bioness Vector, as well as all the traditional physical therapy equipment one might use to address ambulation (rehab aides, braces, assistive devices, gait belts, etc.) Your CI says, “Both the stim bike and the Bioness Vector might be appropriate for this patient. But, they are in high demand so we have to choose only one to start with, and I have to convince the rehab director that this patient should get a spot. What do you want me to recommend?”

Time for student to complete the activity: Class time completion of the activity: 3 hours

Readings/other preparatory materials:
Students had received a module on body-weight supported treadmill training and its application to the stroke and spinal cord populations in Neuromuscular physical therapy I, which is presented by a local practicing clinician. There is no other preparation except for individual student experiences while on clinical rotations and/or class-related visits to local rehabilitation hospitals.
This in-class activity is followed by an evening lab activity at a local rehabilitation hospital in which each piece of equipment is demonstrated by an expert practicing clinician in a station format. This is followed by a discussion which is led by the clinicians and course director together.

Learning Objectives:

1. perform an efficient and accurate internet and literature search with respect to the assigned piece rehabilitation technology.
2. demonstrate accurate knowledge of selected rehabilitation technology is, including a brief overview of related current evidence
3. synthesize new information by comparing, contrasting, and debating the attributes, literature support, and practicality of two different pieces of rehabilitation technology with respect to a given patient case scenario.

Methods of evaluation of student learning:
The rubric for grading is also posted for students while they are working on Part 3. The power point slide is as follows:
- Limited to 1 single typed page with font no smaller than 11 point.

- Your grade will be worth 20 points:

- Minimum of TWO research articles are used appropriately to support a cohesive argument that meet the following criteria (6pts):

 Articles may support your stance or refute the opposing stance

 Articles must be published within the past 10 years

 Articles must not have been presented as part of PT601 or PT616

- Respect is paid to each side of the argument through thoughtful comparison between the two devices with statements that support and/or refute each; well-founded arguments that neither device is beneficial over no-device use will be accepted. (6pts).

- Your paper represents a conclusive, evidence-based, and clearly conveyed recommendation for the device that you choose, which reflects the current state of the literature with respect to this topic (6pts).

- Grammar, spelling, and references are appropriately addressed. (2pts)

\*\**A list of complete references noted in this assignment must accompany your argument. This list may be on a second page\*\**