**Title and Focus of Activity**: Gait Lab for Stroke

*Plan of Care/Intervention*

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**Course Information**: Physical Therapy Management of the Adult with Neurological Conditions I; 3 units; Fall 2nd year of a 3 year DPT program. This is the first Clinical Management course for Neurological Patients. Students have had all Basic Science Classes.

**Learning Activity Description**:

Context: This lab follows a lecture class on Gait & Interventions for gait recovery after stroke.

Five videos of stroke survivors performing the Motor Assessment Scale are uploaded to the electronic course for this class. Prior to the Gait Lab session, students must view one of the five videos and write a group plan of care (POC).

Purpose Students use their examination findings from the MAS videotape to create a problem list utilizing the ICF framework and develop interventions that enhance recovery of standing and gait activities. In addition, they must formulate appropriate short and long term goals and document the gait function observed on the videotape in an objective format for SOAP note. Finally, as they rotate through the stations, they practice additional skills which facilitate recovery of gait function.

During Lab the students rotate through the stations practicing various interventions on each other. In the fifth station they practice whatever they have planned in their group POC for the videotape patient (role-played by the instructor). Once in lab, they may tweak their interventions based on the lab stations they rotate through including one where they execute their intervention and receive constructive feedback from a lab instructor.

Instructions for Students:

*Remember all the variables that affect practice and learning. Remember what you need to do to assess learning.*

PT equipment at your disposal:

* Orthotics • bolsters
* Assistive devices • obstacles (stationery/moving)
* Modalities (FES, biofeedback) • stools
* Music • balls
* Surfaces (level, unlevel (ramps, stairs, rugs, tile, street, etc…))
* Dual task (walk & talk, walk & carry, walk & pull, walk & push, etc…)
* Speed

Practice the following stations. Pay specific attention to how you would guard a patient, how to recognize you should progress/regress a patient and what to do for the progression/regression. You should be thinking about the low level patient and the higher level patient (use the 5 patients on the MAS videotapes for reference). We have a 2 hour lab so each station is given approx. 20 minutes.

1. Step test (3” step), practice administering the standing components of the PASS. Strengthening activities in standing/modified standing (Refer to Table 15.7 Shumway-Cook & Woollacott Textbook; e.g. Heel raises – in sitting and standing (parallel bars with 2 feet and 1 foot, using chair)
2. Beginning ambulation activities: control of head/arms/trunk (how much trunk support is needed in stance?); feet parallel, feet staggered and when stepping; single limb stance (how much support of the limb and where?); limb advancement (how much support is need at the limb to advance and how will you do this?). Where should you do these activities (free space, // bars, AD’s)? Also practice Lunges – in different directions, amplitudes, with/without arms, speed changes.
3. Retrain ankle strategy, hip strategy, step strategy (different directions).
4. NMES/FES while walking. Where would you place the electrodes to prevent foot drop and where will you place the heel switch? (we have portable NMES unit that has a heel switch which can trigger the circuit to connect when the heel is off the ground in swing). Also practice ace wrapping of ankle for DF assist and mirror box training.
5. Patient Groups- practice your interventions for the assigned patient. The lab instructor will be the patient and will provide feedback to the students during the execution of their gait interventions.
6. Post-lab Assignment, due XXXX

Please watch each of the 5 patient videos again. Think about the following for each patient but for your group’s patient demonstration (see below) please complete the following and hand in (one/group) on lab day:

* Identify the problems you observed in the patient’s performance. Separate out activity limitations from impairments.
* Describe the gait as you would in the objective section of a SOAP note
* Develop a treatment plan that addresses all the standing and ambulation problems identified.

*Specific Instructions for Intervention Development:*

*a) The standing intervention should include 2 traditional therapeutic exercises (e.g. strengthening/stretching) and 2 modifications of the standing task (include your variables which affect practice and learning and your regulatory features of the environment here).*

*b) The ambulation recovery intervention should include 2 traditional therapeutic exercises (e.g. strengthening/stretching) and 2 modifications of the ambulation task (include your variables which affect practice and learning and your regulatory features of the environment here).*

*c) Each intervention should address at least 3 problems, so please identify what problems each intervention is addressing.*

* Be specific with your treatment plan. For instance, how would you instruct the patient? How much practice? The order of practice? What task/tasks will be practiced?
* *Write functional short (1 week) and long term (4 weeks) goals for standing and ambulation activities (use the taxonomy of tasks here to help you). Make sure your goals are objective and quantifiable.*
* How would you guard this patient during the execution of your treatment plan? How would you assess your treatment efficacy?
* How would you progress the patient?

*On Lab day, your group will be demonstrating your interventions and getting feedback from the course instructors and your peers.*

*Group Assignments*

*Group 1 – Patient 4*

*Group 2 – Patient 5*

*Group 3 – Patient 1*

*Group 4 – Patient 2*

*Group 5 – Patient 3*

Time for student to complete the activity:

1. preparation for activity outside of/before class: Students are required to prepare their lab case prior to attending lab class. This requires viewing of a videotaped patient performing the Motor Assessment Scale (20min) and designing a plan of care (using ICF, gait documentation (O in SOAP), creating goals, and proposing interventions) (30 - 40min).
2. class time completion of the activity: 2 hours

Readings/other preparatory materials:

This following material is assigned for the gait lecture and the lab components of the course. We have 2 lectures and 2 lab opportunities to cover gait recovery, including outcome measures.

1. Shumway-Cook A, Woollacott MH (2012) *Motor Control Theory and Practical Applications. 4th Edition.* Lippincott Williams & Wilkins, Philadelphia, PA. Chapters 14 & 15.
2. Stroke EDGE documents from APTA Neurology Section –all the measures recommended for entry-level education.
3. Perry J, Garrett M, Gronley JK, Mulroy S. (1995) Classification of walking handicap in the stroke population. Stroke. 26(6): 982-989.
4. Duncan PW.  Sullivan KJ.  Behrman AL.  Azen SP.  et al.  (2011) LEAPS Investigative Team. Body-weight-supported treadmill rehabilitation after stroke. New Eng J Med; 364(21):2026-36.
5. Bassile CC, Hayes S. (2015) Chapter 9 Gait Awareness. In Gillen G (Ed), *Stroke Rehabilitation: A function-based approach. 4th Ed*. Elsevier, St Louis, MO. Pp.194-223.

Learning Objectives:

1. Synthesize information from patient observation on the MAS videotape to establish a therapy diagnosis for the gait observed, prognosis (expectation of gait recovery), goals (short and long term gait outcomes) and gait intervention.
2. Implement a plan of care to enhance gait recovery that optimizes patient outcomes within the care setting for the patient and displays safety awareness of self and patient.
3. Using the SOAP note format, prepare appropriate documentation of gait function observed from the videotape patient case. This is assessed in the write up which is handed in. (see below)
4. Assess your peer and yourself.

Methods of evaluation of student learning:

Since this is a laboratory, lab instructors are monitoring student participation and didactic skills. The patient case that each group writes up is graded with a √, √+, √- and returned to the student group to enhance learning. Below are examples of student group write ups with instructor comments added.

***CVA Lab: Upright Postural Control & Gait Intervention I***

***Group 3 Patient 1***

**Patient 1: left side affected**

1. Identify the problems you observed in the patient’s performance. Separate out activity limitations from impairments.
   1. **Activity Limitations**:
      1. Getting to the toilet in a timely manner
      2. Grocery shopping (pushing the carriage and walking the isles)
      3. Can’t cross the street in a safe & timely manner
   2. **Impairments:** 
      1. Slowed walking speed
      2. Impaired L DF during gait
      3. Inability to stand with weight evenly distributed on the feet during a sit to stand transfer
2. Describe the gait like you would in the objective section of a SOAP note

Pts (gait isomit) ambulates with slowed gait speed of 0.25m/s. Gait (occurs withomit) deviations include: a Left shortened single limb stance time on the left side and a lengthened swing phase on the (rightomit) left side (left side compared to right). Left Double limb support time is increased, and step lengths are asymmetrical (L>R). Pt exhibits left side shuffle gait (lack of toe clearance) and left hip circumduction. what about guarding and distance ambulated?

1. Develop a treatment plan that addresses all the standing and ambulation problems identified.
   1. **Standing Intervention:**

TherEx 1: Pt will be seated on an unsupported surface (?) with both feet planted firmly on the ground. Therapist will stand 10 feet away and roll a ball on the ground towards the patient. The patient will be instructed to use the uninvolved foot (her right foot) in order to kick the ball back to the therapist. Nice activity. I’d have the patient alternate feet to kick (you’ll get DF/knee extension with hip flex, etc…)

* + - 1. Modification: The ball is placed in front of the patient instead of being rolled to her. This will allow more conscious planning of body support through the involved extremity.
      2. Variables affecting practice and learning
         1. Variability of the task (i.e. is the therapist rolling the ball to the same place?)
         2. Practice time
      3. Regulatory Features of the environment
         1. Surface of the floor
         2. Size of the ball
         3. Weight of the ball
         4. Speed of the ball
         5. Distance to therapist

f. features of the seat (chair height, seat surface, armrest/no armrest

* + - 1. Guarding: If unsafe in the unsupported position, the ball will be placed stationary in front of the patient and the PT will guard the patient.
      2. Progression: The patient will attempt the same activity while standing okay but I’d progressively raise the height of the chair which will decrease the thigh support and increase the loading through the legs.
    1. TherEx 2: Pt will be seated with the feet planted firmly on the ground. The physical therapist will be standing 7-10 feet away from the patient then hit a balloon to the patient and instruct them to hit the balloon with their involved arm.
       1. Modification: The patient can start holding the balloon and try and hit to the therapist.
       2. Variables affecting practice and learning
          1. Practice time
          2. Is the therapist throwing to the same spot every time
       3. Regulatory Features of the environment
          1. Speed of the balloon
          2. Size of the balloon
          3. Distance of the therapist
       4. Guarding: Therapist will stand by and guard if necessary and an aide or tech will throw the balloon towards the patient.
       5. Progression: The patient can stand up and do the same task to make it more difficult. Same as above.
    2. Problems Addressed (at least 3)
       1. Uneven weight distribution (forcing weight on the involved side while involved side kicks the ball (reaching and hitting the balloon with the involved hand will force the load through the involved leg only if the balloon is hit at >50%arm’s length or when towards the involved side )
       2. Helping balance in weight bearing
       3. Weakness in the involved side
  1. **Ambulation recovering intervention:**
     1. TherEx 1: Patient will walk a 20ft long pathway with 6 inch high cones placed at regular intervals. Repeat 2x (nice activity. The patient will cheat with a cone and circumduct below the top of the cone. Try using a longer obstacle of similar height and width (e.g. bolster) so you get hip, knee or foot elevation to clear
        1. Modification: A taller or shorter cone can be substituted in order to progress or regress the intervention. An unstable surface can also be added to the task. Add a timed element to the intervention.
        2. Variables affecting practice and learning

1. Part v Whole: Have the patient practice stepping over a single cone then integrate it into the whole task of stepping over the cone while walking.
2. Practice time
   * + 1. Regulatory Features of the environment
3. Height of the cone
4. Walking surface
5. Timing the task
   * + 1. Guarding
6. Therapist will walk alongside the patient and contact guard while she steps over the cones.
   * + 1. Progression

Increase the height of the cones, stagger the cones, make the course longer.

* + 1. TherEx 2: Patient will walk a 20 foot pathway with markings every 0.5m (this is a visual cue), indicating the distance the subject should step with each foot.
       1. Modification: A longer or shorter distance can that each foot must step would progress or regress the activity. Nice activity
       2. Variables affecting practice and learning
          1. Practice Time
          2. Selection Pressure: distance (step length)
          3. Variable vs. Constant Practice: For variable practice, change the floor surface
          4. Feedback – visual cues are constant so have a section with no cues
       3. Regulatory Features of the environment
          1. Floor surface
          2. Distance required to walk (adjust the markings on the floor) (take their leg length and adjust up to 75%)
       4. Guarding
          1. Contact guard as the patient walks the 20 foot pathway
       5. Progression
          1. Increase the distance the patient must step
    2. Problems Addressed (at least 3)
       1. Decreased Dorsiflexion
       2. Decreased step and stride length
       3. Decreased gait speed
       4. Decreased dynamic balance

1. **Functional Short Term Goals (1 week)**
   1. Standing
      1. Within 1 week, the patient will be able to perform a sit to stand task from a standard height chair without swaying from side to side (does this infer equal weight distribution or no loss or balance?) You need to add level of assistance, also, think about the number of reps performed in a day for someone who is a household ambulator. You may be able to modify the goal to include this aspect. Remember what your definition of skilled action includes “success consistency and economy of effort” so measure those components (reps, time etc…)
   2. Ambulation
      1. Within 1 week, the patient will be able to walk 10 meters in 40 seconds while avoiding obstacles (stationary or moving?) in the pathway. Also for household ambulation she’ll need at least 100’ (about 33m)
2. **Functional Long Term Goals (4 weeks)**
   1. Standing:
      1. Within 4 weeks, the patient will be able to perform a sit to stand task 5 times (give a time that meets the criteria for not a fall risk) without swaying from side to side, (same as above) so that they will be able to rise safely from a chair when they return home. (level of assistance?)
   2. Ambulation:
      1. Within 4 weeks, the patient will be able to walk 25 meters in 40 seconds (gait speed 0.6m/sec) while avoiding obstacles in the pathway, so that they will be able to return to (least) community ambulation. (remember community ambulation is at least 1000’ so you need to include a goal for this and speed ramps up for crossing the street (needs to be >=1m/sec) so have a goal for this as well if you want the patient to be a community ambulator.

MAS scores: put this on the first page to refresh all our memories

**Supine to sidelying over intact side:**

* Score: 6

**Supine to sitting over side of the bed:**

* Score: 6
* Notes: somewhat uncoordinated and not entirely smooth; completed in 3 seconds

**Balanced Sitting:**

* Score: 6

**Sitting to Standing:**

* Score: 2

**Upper Limb Function:**

* Score: 6

**Hand Movements:**

* Score: 6
* Notes: with ball exercise, we see excessive shoulder shrugging on the left side

**Advanced Hand Movements:**

* Score: 6

**Walking**

* Score: 4

**Group 2, Patient 5 Lab Write Up**

**CVA Lab: Upright Postural Control & Gait Intervention I**

**I. Problems observed**

* Impairments:
  + Standing balance, uneven weight distribution on LE when standing, lack of full extension of the hip and knee on the involved side and inability to load L LE without using R UE during sit to stand when preparing for ambulation, L LE weakness, L swing limb advancement (foot drop, circumduction), L stance phase (hip drop, knee buckling)
* Activity Limitations:
  + Independent sit-to-stand transfers, independent household ambulation, stair navigation.

**II. Objective: Gait description**

* The pt. displays profound L LE weakness with an inability to maintain stance phase stability on the L LE seen through a R hip drop and L knee buckling. L LE requiring Mod. Assist from PT to prevent L knee buckling.
* Patient also exhibits impaired swing limb advancement of the LLE with L foot drop, L hip circumduction, L forefoot contact and knee flexion at initial contact.

**III. Treatment Plan**

* *Standing interventions*:
  + Ther ex 1: Standing weight shifts with emphasis on glute med activation
    - Purpose:  Standing balance and COM control, improve glute med strength, stance limb stability
    - Modifications:
      * Weight shifts: Begin with feet square and slowly progress to narrower base of support (a semi-tandem stance) in preparation for ambulation.
      * Can also add/remove UE support, change surface standing on (less firm = more difficult).
  + There ex 2: Reaching while static standing: Reach for objects placed towards the involved side while maintaining static standing balance
    - Purpose: Promotes loading of the involved limb as well as challenges dynamic balance and COM control. This will help to strengthen the involved limb functionally and promote a lateral weight shift similar to that required during ambulation.
    - Modifications:
      * Add time component to reaching: Have patient reach for objects in front of them at an extrinsically set speed using patient’s favorite music. This will encourage weight shifts during ambulation that are extrinsically paced.
      * Vary distance patient needs to reach to alter task difficulty.
  + VAPAL
    - Mental practice can be utilized during rest periods
    - Amount of practice can be increased as patient stamina increases.
    - Practice can be randomized between tasks to facilitate greater retention
  + Regulatory Features
    - Surface (carpeting), Distractions (other patients/noise), Lighting, Obstacles, Externally imposed timing constraints.
* *Ambulatory Interventions*
  + Ther ex 1: Standing weight-shifts using a parallel bar for support
    - Purpose: Improve balance and COM control, facilitate quad control and promotion of terminal knee extension in preparation for walking
    - Modifications: Pt. holds parallel bar for support and lifts the unaffected leg up from the floor slightly; practices bending and straightening the affected stance leg several times. PT may provide verbal cues for positioning. Could also progress to taking one step forward and back alternating legs.
  + Ther ex 2: Walk 30 feet x 2 using hemi cane with CG for safety.
    - Purpose: improve endurance, walking speed, normalize temporal spatial measures of gait.
    - Modifications: Walk 30 feet x 2 feet using hemi cane with CG to an extrinsically set pace (patient’s favorite song). Focus is placed on maintaining an elevated walking speed for the full distance.

Ambulation task modifications:

* Increase amount of practice (ambulation training variables: longer practice session duration requiring more endurance, more frequent practices)
* Establish new time goals/modify speed component (6MWT time at 10m pace)

**IV. Treatment plan guidelines and order.**

* This patient would likely initially need prescriptive tactile feedback to aid in balance, recruiting the correct muscles, and reestablishing a functional gait pattern. The tactile feedback could be diminished as she becomes more independent and the therapist could be less hands on. The transition could be to visual and verbal feedback given in a more intermittent matter as she progressed. Practice will be done in a blocked manner, as the tasks themselves will be very difficult for her and she does not need additional cognitive interference.

**V. Goals**

* Short Term:
  + In one week, the patient will perform a sit to stand transfer with contact guard maintaining at least 70% equal weight distribution from R to L LE in order to safely rise from a chair in her home.
  + In one week, the patient will be able to stand with weight evenly distributed through both legs with CG assistance and minimal verbal cuing for 10 seconds in order to improve standing in the kitchen and completion of daily activities.
  + In one week, the patient will walk 30 feet using a hemi cane with CG at 0.3 m/sec without knee buckling in order to increase endurance and ambulate safely at home.
* Long Term:
  + In 4 weeks, the patient will perform a sit-to-stand transfer independently maintaining 90% equal weight distribution from R to L LE in order to facilitate independent toileting.
  + In 4 weeks, pt. will improve score on the Step Test to >7 steps with verbal cues for positioning in order to improve dynamic balance and lower extremity motor control in order to ambulate more safely around her house.
  + In 4 weeks, the patient will walk 30 feet x2 using a hemi cane with CG for safety at 0.58 m/sec in order to ambulate safely in the home and with assistance in the community.

**VI. Conclusion**

* *Guarding*
  + The patient would be guarded on the L side, with contact guard initially, progressing to close supervision. The efficacy of the treatment would be assessed at least 24 hours after each session. Successful treatment would be indicated by improved ability to equally distribute weight when standing, a faster gait speed, improved walking endurance, increased step length, and more symmetry within stance and swing on the LLE and between the LLE and RLE.
* *Progression*
  + Difficulty of the therapeutic interventions would be modified as described in section III: Treatment plan. Variables of practice including the amount and randomization of practice, the manipulation of the environmental regulatory features, and the type and level of feedback provided to the patient would be manipulated in order to add complexity to the patient’s learning.

***Group 2 – Patient 5 sit to stand 6:39, walking 10:25***