**Title and Focus of Activity:** Motion Analysis of Sit-to-Stand and Gait: 4 Neurological Pathologies

*Movement Analysis/Intervention*

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**Course Information**: Neurological Physical Therapy II; 4 semester hours; 5th semester (2nd fall semester after 2 summer semesters, one fall semester, one spring semester, and one summer clinical). Students have completed Neurologic Physical Therapy I (Neuroanatomy, neurophysiology, and neurologic assessment, including gait) and Human Development Across the Lifespan in Spring I. In addition, they have studied normal gait and gait deviations in Functional Anatomy (Summer 1) and mobility and gait assessment in Foundations of Physical Therapy (Fall 1).

Learning Activity Description:

Purpose: The purpose of this assignment is to provide the student with an in-depth understanding of common functional movements and how these movements may be altered in the presence of specific neurological conditions.

Context: This assignment builds from a previous motion analysis assignment - Motion Analysis of Sit-to-Stand and Gait: Across the Lifespan (separate Compendium submission). It is assumed that the student has gained an understanding of the nature of both movements for the healthy, young adult. Therefore, this assignment will build from the previous assignment, focusing only on the contrasts between the young adult and what would likely be observed for the individuals described above.

Students analyze two movements—the sit-to-stand transition and level-surface walking. These movements are analyzed for four different individuals—older individual with hemiparesis, child with cerebral palsy-spastic quadriplegia, middle-aged adult with multiple sclerosis with cerebellar involvement, and older individual with Parkinson’s Disease.

Student Instructions:

1. Students will work in groups of 4 for this assignment. Within the group of 4, one student should take the lead for each diagnosis. For example, the student that chooses the hemiparesis case should play the role of the PT in the hemiparesis video, create the home exercise program, and post the materials to the course management site. However, each group member should be involved in the analysis and development of the plan of care and home exercise program. Please list all group members on your submission.
2. All student groups will analyze two movements—the sit-to-stand transition (STS) and level-surface walking. These movements will be analyzed for 4 individuals with neurological diagnoses, as follows:
   1. Older adult with right hemiparesis with mild cognitive impairments
   2. Child with spastic quadriplegia
   3. Middle aged adult with multiple sclerosis with cerebellar involvement with impaired judgment and short term memory
   4. Older adult with Parkinson Disease (Hoehn & Yahr Stage 3) with decreased sensation and vision secondary to Diabetes Mellitus
3. The assignment consists of three parts. The first portion will be an analysis of the two motions - sit to stand and gait. The second part will consist of a student-generated video of a treatment session appropriate for the individual. The final portion for each patient will be an electronic home exercise program designed for the patient and his/her functional limitations, using the Wellpepper Clinic application.

Part A**:** A video of an individual with the appropriate neurological pathology (hemiparesis, cerebral palsy, multiple sclerosis, Parkinson’s disease) performing these tasks (sagittal and frontal view) is posted to the course management site. In groups of four, the student groups analyze the two motions, using motion analysis software and the terminology and phases provided in the posted references. Dartfish or Kinovea may be used for motion analysis. Dartfish must be purchased by the department or students. Kinovea ([www.kinovea.org](http://www.kinovea.org)) is a free motion analysis program (Window compatibility only) that also can be used—see website to download. A Power Point presentation will be developed to present the student group’s finished assignment. Please also post it to the assigned tool on the course management site.

Use the Dartfish software (or other motion analysis software, i.e Kinovea) to identify the start and finish of each phase of the movement. For example, find the start and finish of the loading response in gait or the flexion-momentum phase in sit-to-stand. Identify how this person differs from the healthy adult IN EACH PHASE of movement. Use Dartfish to illustrate these differences (i.e drawing joint angles, ground reaction forces) when appropriate. You may use the healthy adult video from Motion Analysis of Sit-to-Stand and Gait: Across the Lifespan (Compendium submission).

Please consider the whole body, not just the legs. Analyze the motion at the hip, knee, ankle, upper extremities, and trunk in both sagittal and frontal planes. Also, describe the base of support compared to the healthy adult, as well as asymmetries observed.

Based on your analysis, generate a list of all movement deviations observed during the movements (one list for gait and a separate list for STS). For each movement deviation, list the most likely body function contributors to that movement deviation. Using your clinical reasoning skills, rank these deviations, with the deviation you feel impacts gait or STS most significantly at the top.

Part B: Using your priority list as a guide, design an intervention for each individual,

focusing on the top 2-3 movement deviations identified. Each student group will create a video and post A YOUTUBE LINK within the designated course management site. The Youtube video should be posted using the Unlisted privacy setting. The video will consist of one student acting as the patient and a second student acting as the treating physical therapist. In each video, demonstrate how you would address the inefficient functional component(s) in a 10-MINUTE treatment session for each of the functional movements (STS and gait). Follow this treatment demonstration with a written explanation of why you chose this approach, what exactly you are doing, what response you are looking for in the patient, and how you plan to progress the intervention.

This is your opportunity to showcase your hands-on skills. Therefore, it should not be a video of you telling the viewers what you would do. Instead, the video should serve as a “window” into an actual treatment session with this patient. For this video, focus on movement impairments that would require hands-on intervention by the physical therapist.

\*\*Each video should be 10 minutes maximum per task (STS and Gait).

Part C: Home Exercise Program: Students will create a home exercise program for each patient, using the Wellpepper Clinic application (http://wellpepper.com). This application can be used on ipads, iphone and Android phones or tablets. Focus the home exercise program on the functional limitations addressed in Part A & B, utilizing 4 exercises. Please select your exercises and their progressions thoughtfully. Each exercise should address at least 2, preferably 3 impairments simultaneously. Please provide a rationale for the home exercise program. Keep in mind the patient’s abilities and/or limitations when designing the program.

1. A minimum of two references is required, and should be cited according to American Medical Association citation style. These references should pertain to your choice of intervention.

Time for student to complete the activity:

* + preparation for activity outside of/before class: **16 hours total (approximately 4 hours for each of the 4 components of the assignment)**
  + class time completion of the activity: **0 hrs**

Readings/other preparatory materials:

1. Schenkman M, Berger RA, Riley PO, Mann RW, Hodge WA. Whole-body movements during rising to standing from sitting. *Physical Therapy*. 1990;70:638-648.
2. Gait: Overview, Overall Measures, and Phases of Gait. Accessed October 11, 2015. <http://courses.washington.edu/anatomy/KinesiologySyllabus/GaitPhasesKineticsKinematics.pdf>.
3. Stout J. Gait: Development and analysis. In: Campbell SK, Palisano RJ, Orlin MN, eds. *Physical Therapy for Children*. 4th ed. St. Louis, MO: Elsevier, 2012. <https://evolve.elsevier.com/cs/product/9781455777150?role=faculty>. Accessed October 10, 2015.
4. Burnfield JM, Norkin CC. Examination of Gait. In: O’Sullivan SB, Schmitz TJ, Fulk GD, eds. *Physical Rehabilitation.* 6th ed. Philadelphia, PA: FA Davis; 2014:251-259.

Learning Objectives :

1. Identify the following related to the sit-to-stand and gait movements of 4 patients with neurologic conditions using motion analysis software: description of start and finish of each movement phase, function of each movement phase, kinematics of the each movement phase, and the kinetics of each movement phase.
2. Use motion analysis software to provide visual images of the start and finish, joint angles, and ground reaction forces within each movement phase for movement analysis.
3. Compare the motion analyses (sit to stand and gait) of individuals with neurological pathologies to the expected ‘values’ for the healthy adult.
4. Identify the most critical movement issues in sit to stand and gait to address with physical therapy interventions in individuals with neurological pathologies.
5. Design and execute an intervention session to address the identified movement issues in individuals with neurological pathologies.
6. Design and execute a home exercise program using the Wellpepper Clinic application to address the identified movement issues in individuals with neurological pathologies. (Wellpepper pricing: After a discussion with Wellpepper, they suggested using an individual license for our department. An individual license allows you to use up to 30 clients without a charge. Wellpepper does not publish pricing on their website for other options.)

Methods of evaluation of student learning:

The instructor completes a motion analysis of the sit-to-stand and gait of each video. This provides both a model by which to grade the assignment, as well as a model for students to review after the assignment is graded and returned.

GRADING: This assignment is worth 320 points total—each pathology is worth 80 points.

1. For the motion analysis portion, the student is graded on the accuracy of the analysis, judgment in identifying and prioritizing movement deviations and body function impairments , and the utilization of the software.
2. For the treatment portion, the student is graded on choice of intervention(s), the accuracy and quality of the delivery and exercise prescription, and the efficiency of choices (does the intervention address multiple areas(?)

**Neurological Pathologies Motion Analysis Assignment Rubric**

**Part A - Gait (14 pts total):**

Accurate analysis of impairments leading to movement dysfunction in various phases of gait (12 pts) \_\_\_

* BOS:
* Foot/ankle:
* Knee:
* Hip:
* Head/trunk:
* UE:

Appropriate use of terminology (2 pts) ­­ \_\_\_\_

**Part A - STS (12 pts total):**

Accurate analysis of impairments leading to movement dysfunction in various phases of STS (10pts)\_\_\_\_

* BOS:
* UE:
* Head:
* Trunk:
* Hip/knee/ankle:

Appropriate use of terminology (2 pts) \_\_\_\_

**Part A - General (5 pts total)**

Utilization of technology: (2 pts) \_\_\_\_

* joint angles and GRF drawn accurately
* drawings and measurements chosen to highlight add to the description

Problem list ranked in logical order of greatest impact on movement (3 pts) \_\_\_\_

**Part B - Gait Intervention Video - Part B (20 pts total):**

Interventions focused on movement deviations/body function impairments according to ranked problem list (2 pts)\_\_\_\_

Accurate demonstration of two intervention techniques (8 pts) \_\_\_\_\_

* instructions, verbal and/or tactile cues
* positioning
* exercise prescription (intensity, duration)

Efficiency of interventions (do they address multiple issues?) (2pts) \_\_\_\_\_

Rationale for intervention techniques (3 pts) \_\_\_\_\_

Response used to assess success or failure of intervention strategy (3 pts) \_\_\_\_\_

Appropriate use of terminology (2 pts) \_\_\_\_\_

Comments:

**Part B - STS Intervention Video (20 points total):**

Interventions focused on movement deviations/body function impairments according to ranked problem list (2 pts)\_\_\_\_

Accurate demonstration of two intervention techniques (8 pts) \_\_\_\_\_

* instructions, verbal and/or tactile cues
* positioning
* exercise prescription (intensity, duration)

Efficiency of interventions (do they address multiple issues?) (2pt) \_\_\_\_\_

Rationale for intervention techniques (3 pts) \_\_\_\_\_

Response used to assess success or failure of intervention strategy (3 pts) \_\_\_\_\_

Appropriate use of terminology (2 pts) \_\_\_\_\_

Comments:

**Part C - Written Plan of Care/Home Exercise Program (9 pts total):**

Treatment plan to treat both STS and gait including HEP (1 pt) \_\_\_\_\_

Method of progression (3 pts) \_\_\_\_\_

Modification of task/environment in plan of care (3 pts) \_\_\_\_\_

Two references-AMA citation style (1 pt) \_\_\_\_\_

Spelling/grammar (1 pt) \_\_\_\_\_

Comments: **/80 points**