**Title and Focus of Activity:** A Flipped Classroom Approach to Teaching Introductory Vestibular Rehabilitation Skills in a Laboratory Setting *Patient/Client Management Model; Innovations*

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**Course Information:** Motor Control and Motor Learning; 4 credit course; should follow an introduction to the vestibular system through neuroanatomy, balance assessments, and vestibular rehabilitation. This laboratory activity is meant to coincide with the didactic introduction to vestibular rehabilitation. Depending on the program, this learning activity may fit in the neurologic physical therapy curriculum or in the motor control curriculum with an emphasis on integrating the vestibular system in balance retraining.

**Learning Experience Description:** Context/Purpose: Using a flipped class room concept, the overall goal of the lab is to allow students more time applying introductory concepts of vestibular rehabilitation to patient cases. Students are asked to view videos of vestibular examination and intervention techniques prior to attending the laboratory session but after receiving the lecture introductory content. During the laboratory experience, students partner up to role play a physical therapist and a patient with vestibular dysfunction in order to apply the techniques to patient case scenarios. They are provided with guidelines for the role of the physical therapist in order to better guide their learning around examination and intervention techniques specific to vestibular rehabilitation. The 4 cases selected target the most commonly treated vestibular dysfunctions with respect to exposure across the life span and across the continuum of care.

Instructions for Laboratory Activity: Application of Vestibular Examination and Intervention Techniques

* Students will break up into pairs and rotate through 4 stations associated with 4 different vestibular cases.
* For each case, one student will role play the physical therapist and one student will role play the patient.
* After reading the case, the student role playing the physical therapist will complete the parts of the physical therapy examination and treatment that have been identified for that case. Due to time constraints, a full vestibular evaluation will not be possible for each case. Therefore, “Additional Examination Findings” are listed to acknowledge other tests may be appropriate for the case.
* The students will switch roles after completing the case one time through so that all students practice each technique.
* Following the subjective history, the students should discuss what signs and symptoms they anticipate to see in the patient given the case scenario.

Case 1: BPPV - Outpatient

A 51 year old patient presents to an outpatient physical therapy clinic with complaints of dizziness that started after tripping and falling when in the garden. The patient reports it gets worse when getting in and out of bed, rolling over or bending over to tie her shoes. She reports she feels nauseated and unsteady for a short time, but if she sits still, it gets better. She has been able to remain independent with all functional mobility.

Physical Therapist Instructions:

Questions to ask: 1. Did you hit your head when you fell?
2. Can you describe the dizziness? Light headed, room spinning, off balance?
3. In what position is the dizziness the worst?
4. How long would you say the dizziness lasts? Seconds vs minutes?

List signs and symptoms you anticipate the patient to demonstrate if presenting with BPPV:

Additional Examination Findings:

1. Visual Screen is clear 2. Intact Saccades and Convergence 3. Patient is independent with gait and sit to stand transfers without an assistive device as observed when walking into the clinic and the transfer from a chair in the waiting room.

Practice the Following Tests using Frenzel Goggles

1. Complete Screening for Vertebrobasilar Insufficiency and cervical ROM 2. Dix Hallpike Starting with LESS involved side 3. Dix Hallpike with MORE involved side 4. Horizontal Roll Test Starting with LESS involved side 5. Horizontal Roll Test with MORE involved side

\*At any point that the patient reports a significant increase in symptoms or you observe nystagmus consistent with BPPV, stop and provide intervention.

Interventions to Practice for BPPV

1. Epley Maneuver for Positive Dix Hallpike 2. BBQ Roll for Positive Roll Test

Post Intervention Education

1. Precautions following canalith repositioning technique including: avoid lying flat for the rest of the day, avoid rapid head turns for the rest of the day, drinking plenty of water to stay hydrated, continue with normal activity the next day.

2. Expectations on how the patient should feel including: may not feel so great the rest of the day but should notice a significant improvement in dizziness with positional changes within 24 hours.

3. Patient should pay close attention to positions that continue to evoke symptoms as that will help with ongoing treatments and differential diagnosis.

Case 2: Unilateral Vestibular Hypofunction

A 8 year old child is seen in the outpatient physical therapy clinic due to the child’s parents reporting the patient is demonstrating difficulty keeping up with his friends at school. The parents report the child appears clumsy when trying to run and play games that require him to move around a lot. The child has a strong dislike for playground equipment especially swings and the merry-go-round, and he prefers to sit and play in one spot such as in the sand box or coloring. The patient is able to independently walking into the clinic without holding onto his parents, but he appears to be stiff with very little head movements.

Physical Therapist Instructions:

Questions to ask: 1. Do you ever feel dizzy or have an upset stomach when trying to play with friends?
2. Do you ever feel like the room is spinning? If so, do you think it lasts a long time?
3. What is the hardest thing for you to do when playing with your friends?
4. Why do you not like running with your friends or playing on the playground equipment?

List signs and symptoms you anticipate the patient to demonstrate if presenting with unilateral vestibular hypofunction:

Additional Examination Findings:

1. Visual Screen is clear 2. C-spine ROM is clear 3. Dix-Hallpike and Roll Test is negative 4. Unable to maintain single leg stance for >2 seconds on the right LE 5. Independent with floor transfers but performs slowly while being sure to limit head movements 6. Dynamic Gait Index – Total score is 15/24

Practice the Following Tests

1. Dynamic Visual Acuity Test

2. Head Impulse (Head Thrust) and Head Shaking Nystagmus

3. Faduka’s Step Test

4. Sharpened Romberg

5. Vestibular Processing Section of the Sensory Profile

Interventions to Practice for Unilateral Vestibular Hypofunction

1. VOR exercises- emphasis at starting at point below the patient’s threshold and in the appropriate level of postural demand

2. Balance activities challenging appropriate balance systems (head turns, uneven surfaces, position changes). Use games to engage the patient

Post Intervention Education

1. Expectations on how the patient should feel during activities: emphasizing that it is normal to not feel great during exercises/activities, but that is how the system learns to adjust and get better. Encourage the patient to do as much as he can and then take a break. Be reassuring towards patient and listen to patient to help gauge when to stop. Be sure to use age appropriate language.

2. Educate the parent as well on what to expect regarding symptoms during VOR exercises and HEP

Case 3: Stroke – Rehab

A 69 year old patient is being evaluated in the inpatient rehabilitation setting following a cerebellar stroke 2 weeks ago. She required moderate assist for supine to sit and for stand pivot transfers to get to her wheelchair. The patient reported increased dizziness during these initial attempts to get out of bed and the symptoms seem to persist throughout the session even when sitting still. The patient however agrees to keep trying to participate. The patient was able to walk 10 feet with a FWW and moderate assistance for balance. Gait distance is limited by extreme nausea while walking. The therapists notices that the patient closes her eyes when being pushed in the wheelchair to the therapy gym.

Physical Therapist Instructions:

Questions to ask: 1. Can you describe the dizziness you experience?
2. Have you noticed positions that make it worse or make it better?
3. Does it go away when you are not moving?

List signs and symptoms you anticipate the patient to demonstrate if presenting with a cerebellar stroke:

Additional Examination Findings:

1. C-spine ROM is clear

2. Dix-Hallpike results in pure vertical nystagmus that persists >60 seconds.

3. Dynamic Visual Acuity Test (CVA) = 5 line drop

Practice the Following Tests

1. Visual Screen including ROM, smooth pursuits, saccades, convergence, cross-cover

2. VOR cancelation test

3. Motion Sensitivity Quotient Test

Interventions to Practice

1. Habituation exercises- having the patient practice getting in/out of the position that provokes the symptoms. Base # of reps on patient’s severity of symptoms.

2. Compensation techniques to address immediate fall risk– Assistive devices for gait and mobility, turn eyes first and then turn head)

3. Will not have time today, but may also integrate gaze ability exercises (VOR exercises)

Post Intervention Education

1. Expectations on how the patient should feel during VOR exercises: Emphasizing that it is normal for these activities to increase nausea and dizziness. The patient should be instructed to push into these areas of discomfort a little bit but to stop before the symptoms become intolerable. The symptoms should return to baseline within about 1 hour following the treatment session.

2. Educate on homework to perform in seated and supported position for safety: VOR exercises and head turns with emphasis on FITT principle that is appropriate to this patient case

3. Encourage participation in mobility and activity as much as possible.

Case 4: Concussion/Athlete/Mild TBI

An 18 year old athlete is being seen in the outpatient clinic following a diagnosis of a concussion after colliding with a team mate in a recent high school soccer game. The patient walks into the clinic without assistance, but he is accompanied by his mother due to having difficulty with driving. He has been unable to return to practice due to the headaches and not feeling quite steady on his feet when trying to run drills. The patient also reports frequent headaches that seem to get worse when trying to study or when in large crowded rooms at school. He does report some dizziness that comes and goes.

Physical Therapist Instructions:

Questions to ask: 1. Can you describe the dizziness and are there any activities that cause the dizziness?
2. How long does the dizziness last?
3. Is there anything that makes the dizziness or headaches better?

List signs and symptoms you anticipate the patient to demonstrate if presenting with a concussion:

Additional Examination Findings:

1. Visual Screen is clear

2. C-spine is clear

3. Dix-Hallpike test was positive for left posterior BPPV and the Epley maneuver was completed for treatment. The patient was instructed on posterior canalith repositioning instructions and returned 2 days later for continued treatment. The patient’s report of dizziness with position changes had resolved.

4. Dynamic Visual Acuity Test – 2 line drop

5. Unable to maintain single leg stance for >5 seconds on the right LE

6. Functional Gait Assessment- Total score is 22/30

Practice the Following Tests

1. Head Impulse (Head Shake) and Head Shaking Nystagmus

2. CTCIB

3. Parts of the High Level Mobility Assessment Tool

4. Dizziness Handicap Inventory

Interventions to Practice

Dynamic balance activities that integrate various surfaces, head turns and dual tasking (kicking a ball, ect) with attention to onset of symptoms

Post Intervention Education

1. Education on possibility of over stimulation (one sign being headaches and fatigue) and needing rest breaks. Also increasing awareness to environment.

2. HEP integrating VOR exercises and balance exercises at an appropriate FITT level. Provide education regarding what to expect with VOR exercises with an emphasis on listening to the body’s signs of over stimulation. Increase in symptoms should return to baseline within 1 hour

3. Encourage light activity – should not be completely abstaining from exercise so the physical therapist will have to provide education on what is an appropriate level of exercise

Instructor Key for Patient Presentation by Case: Instructors may elect to utilize this information for their own reference or to supplement the case information above during the small group discussion or the final wrap up in order to emphasize signs and symptoms these patients might present with in the clinical setting.

Case 1: BPPV - Outpatient

 This patient did not hit her/his head when she fell. She has consistently felt as though the room is spinning when she first gets up out of bed and bending over to tie shoes. The sensation of the room spinning seems worse when laying on the right side but is lasts for only a 10-20 seconds before going away. This patient has been avoiding laying on the right side in order to avoid this sensation.

Case 2: Unilateral Vestibular Hypofunction

Remember this patient is an 8 year old child and will need to communicate and engage through age appropriate play and basic communication. The patient reports feeling like he might fall over when trying to run or move around a lot on the playground. He feels better sitting still so the symptoms do not last longer than 1 minute. He does not recall the sensation of the room spinning when asked directly about it. He is willing to get into any position the therapist asks but he does it slowly and with limited cervical movements.

Case 3: Stroke

The patient reports feeling nauseated and dizzy with all functional mobility as well as at rest. Despite not feeling well, the patient continues to be agreeable to try anything that the therapist requests. Anything that requires the patient to do something physical, the patient can only do for about 10 second intervals before requesting a break due to increased severity of symptoms. The patient may request to keep an emesis bucket close by and continue closing eyes during positional changes due to nausea. There are no specific positions that the patient reports are worse than others, but this patient really dislikes it when people push the wheelchair too quickly or push her through positional changes rapidly.

Case 4: Concussion/Athlete/Mild TBI

This patient is cooperative but may make frequent comments about how bright the lights are or how loud people are in the room. Initially this patient reports the dizziness as a spinning sensation with the room spinning for a few seconds and then resolving if sitting still. The patient has noticed the dizziness is the worst when getting out of bed in the morning and when bending over to get books out of the locker. He also reports feeling unsteady when he turns quickly to talk with friends in the hallway at school or trying to go kick a soccer ball. Nothing really helps the headaches except going to lay down in a dark room. The physical therapist treated the patient for BPPV on the first visit, and upon returning to therapy 2 days later, the patient reports the sensation of the room spinning has improved. The patient continues to note the same issues with balance, sensory sensitivity and headaches.

Time for student to complete the activity: 1. Preparation for activity outside of/before class: Students spend about 1 hour of time prior to class reviewing videos that demonstrate vestibular rehabilitation techniques. See below for recommend videos to provide students ahead of time. This is in addition to lecture time where the vestibular rehabilitation techniques and concepts are introduced. 2. **Class time completion of the activity:** 1 hour and 50 minutes. Students are broken up into 4 groups, and they rotate between 4 different stations focusing on different clinical cases designed to facilitate learning of specific skills for vestibular rehabilitation. This method also optimizes student access to required equipment. At least 4 faculty or laboratory assistants are required in order to provide feedback at each of the 4 stations. A recommended maximum student to instructor ratio would be 12:1. A sample schedule for the lab is as follows:

5 minutes – Introduction to concept of the lab

23 Minutes at each of the 4 stations

15 Minute large group wrap up. This time can be utilized to reinforce key concepts including why specific tests were performed with specific cases, clarify large gaps in technique that students did not seem to get from the videos, and answering questions.

Readings/other preparatory materials: Prior to attending class, students are expected to view demonstration videos of vestibular tests and interventions including Oculomotor Screen, VOR Cancellation Test, Dix-Hallpike, Epley Manuever, Sidelying Test, Roll Test, Barrel/Bar-B-Que Roll, Head Impulse (Head Thrust) Test, Head Shaking Nystagmus, Static vs Dynamic Visual Acuity Test, Gaze Stability Exercises, and Habituation Exercises which will be utilized in this laboratory session. See course website for instructions on how to access videos and for study guide to assist when viewing videos. See Appendix A for Preparatory Assignment Worksheet

\*\*\*\*Demonstration of each technique will NOT be provided during lab as it will be assumed the students have already viewed the demonstrations online. During lab, the students will be expected to practice these techniques on their lab partner utilizing the clinical case application.\*\*\*\*\*

Instructor Resources: Online videos for vestibular bedside examination and gaze stability exercises accessed at <http://www.vestibularseminars.com/officeexamvideos.html> Videos for BPPV treatment techniques utilized a combination of videos from the link above and free access YouTube videos. The following links may be provided on the course website for student viewing:

* + Epley Maneuver: <https://www.youtube.com/watch?v=9SLm76jQg3g>
	+ Lempert Maneuver (BBQ Roll): <https://www.youtube.com/watch?v=mwTmM6uF5yA>
	+ Liberatory (Semont) Maneuver: <https://www.youtube.com/watch?v=z2KUrQoZ-sU>
	+ Brandt Daroff Exercises: <https://www.youtube.com/watch?v=hhinu_oU_hM>

Learning Objectives: 1. Identify key signs and symptoms associated with vestibular pathology when presented with a clinical case. 2. Demonstrate basic test and measures utilized during an initial physical therapy examination for a patient with vestibular dysfunction. 3. Implement low technology vestibular intervention techniques to address common vestibular impairments. 4. Describe patient education topics that are specific to vestibular rehabilitation.

Methods of evaluation of student learning: See the Compendium Activity entitled “A Laboratory Competency Check-Off to Assess Introductory Skills for Vestibular Rehabilitation”. Student learning related to cognitive components of the vestibular examination and intervention techniques may be assessed through multiple choice exams or essay questions.

Appendix A Study Guide Provided to Students for Preparatory Assignment

During the laboratory experience, you will be asked to perform the vestibular rehabilitation examination and intervention techniques presented in the online videos. Utilize this study guide to take notes on how to perform each technique and bring your completed form with you to lab in order to demonstrate your completion of the preparation assignment

1. Tests found online at <http://www.vestibularseminars.com/officeexamvideos.html> and under the tab Office Exam Videos:
* Oculomotor Screen:
	+ Occular ROM
	+ Pursuits
	+ Saccade
	+ Gaze Holding
	+ Cross-Cover Test
* VOR Cancellation Test
* Dix-Hallpike(Labeled Hallpike #1 and #2)
* Sidelying Test
* Roll Test
* Horizontal Head Impulse Test (aka. Head Thrust)
* Head Shaking Nystagmus Test
* Dynamic Visual Acuity Test
1. Vestibular intervention techniques found online at <http://www.vestibularseminars.com/officeexamvideos.html> and under the tab Gaze Stability Exercises:
* VOR x 1 Exercises
* VOR x 2 Exercises
1. Videos of BPPV Treatment techniques found imbedded on Course Website:
* Canalith Repositioning Technique (Epley Maneuver) for posterior canal BPPV
* Bar-B-Que Roll (Lempert Maneuver) for horizontal canal BPPV
* Brandt-Daroff Habitation Exercises