Neurorehabilitation for the Physical Therapist Assistant

Chapter Questions and Answers

Darcy Umphred, PT, PhD, FAPTA
Emeritus Professor
University of the Pacific
Stockton, California

Constance Carlson, PT, MS Ed
Mount St. Mary's College
Los Angeles, California
INTRODUCTION

On this website, you will find suggested answers to the chapter questions and case study questions presented in the text Neurorehabilitation for the Physical Therapist Assistant, by Darcy Umphred, PT, PhD, FAPTA and Constance Carlson, PT, MS, Ed. The chapter authors have provided these as suggested answers and encourage the readers of the text to have open dialogues with other students, PTAs, and PTs about the answers provided and other potential answers. These dialogues provide important learning opportunities and will hopefully contain discussions regarding the rationale each person has for his or her answer. The rationale for answers may be dependent upon the state laws and regulations pertaining to the practice of physical therapy that impact the role of the PTA in a specific state.

Your feedback on the chapter and case study questions and the suggested answers is welcome. Please submit your feedback to bookspublishing@slackinc.com.

CHAPTER 2

By Dale Scalise-Smith, PT, PhD

CHAPTER QUESTIONS AND ANSWERS

1. Explain why an exercise program would be different for a child than for an adult.

   Physiologic changes occur in all of the body systems across the lifespan. Modifying strength and flexibility of an older adult requires that other systems are capable of modifying performance levels to meet the increased needs of the musculoskeletal system. The cardiovascular and pulmonary systems’ physiologic response to exercise is directly related to the age of the individual. Physiologic response to exercise declines in the older adult. Conversely, physiologic performance of the cardiovascular and pulmonary systems of infants and children improves in response to growth and development.
2. Explain the role of cognition in motor development.

Infants and young children may not use or interpret information as efficiently as older children. During childhood, individuals more accurately identify relevant cues, filter irrelevant information, and process information faster. Optimal processing improves throughout adolescence and into middle adulthood. As an individual grows older, information is processed more slowly, and the time necessary to perform motor skills increases. Additionally, while learning may occur more slowly with age, once a behavior is learned, retention is no different than for a younger individual. While the time necessary to perform the task may increase, older adults are able to execute many tasks without incident.

3. Explain how older adults may differ from younger adults in musculoskeletal parameter.

Musculoskeletal considerations include changes in cross-section of the muscle fibers that directly impact force production. While the older adult’s musculoskeletal system is modifiable, the amount of time necessary for an older individual to regain strength and/or flexibility is longer than children or young adults.

4. Discuss how balance training would differ for a young child not yet walking and an older adult with a history of falls.

Balance and posture incorporates sensory input and motor actions, including visual, vestibular, and somatosensory systems. Young children primarily use visual input to modulate upright posture. Consequently, balance training should focus on the maximizing use of visual system. Older adults have integrated the visual, somatosensory, and vestibular systems. The PT first identifies the system(s) contributing to loss of balance, enabling the PTA to perform intervention activities directed toward improving the impaired system(s) and preventing alterations to other systems.

5. Identify cardiopulmonary changes with normal aging. Discuss how these cardiopulmonary changes affect intervention.

While aging affects the performance and efficiency of the cardiopulmonary and cardiovascular systems, aerobic exercise can improve the capacity and efficiency of the cardiovascular and cardiopulmonary systems. Older adults have less elastic vessels, and resistance to blood volume increases. Consequently, older adults reach peak cardiac output at lower levels than younger individuals do. Changes in the cardiovascular and pulmonary systems have a significant impact on other systems and, consequently, on overall body function.

CHAPTER 3

By Darcy Umphred, PT, PhD, FAPTA

CASE STUDIES

The specific case examples following are patient examples similar to those discussed in later chapters. The PTA is not expected to be able to answer these clinical questions after reading this chapter. Instead, the PTA can use these cases to help integrate the information presented in this chapter with information presented in all the clinical problems chapters. It is recommended that the learner read this chapter, the case examples, and questions in order to identify appropriate questions regarding motor learning, motor control, and neuroplasticity as they relate to patient care. After reading and analyzing any clinical problem chapter, the PTA can return to this chapter, find an appropriate case, and then progress through the questions and answers in order to better integrate this material into clinical intervention decisions.

Case #1

The patient is a 6-month-old child diagnosed with spastic diplegia. She was born 8 weeks premature and was extremely flaccid at that time. The child’s gestational age would be placed at 4 months, giving the child the 8 weeks she should have remained in utero. However, the tonal characteristics of the child are extensor dominant in the trunk and LEs. The child has more control over the arms than legs but loses function of the arms when placed in positions that require a lot of trunk stability, such as sitting or pressure on the feet in standing. The child does not have adequate head control and is unable to roll over, come to sitting, or sit independently. The PT has asked the PTA to first do a handling technique with rotation of the trunk in sidelying. The PTA should rotate the lower trunk on the upper trunk to facilitate rolling and, initially, have one of the patient’s LEs lead with hip and knee flexion (without holding the ball of the foot). Second, the child should be placed on the PTA’s bent knees with the head in vertical and, with small degree changes of the trunk, the PTA should facilitate small movements of the head and, thus, assist the child in gaining head control.
Questions and Answers

1. Why has the PT asked the PTA to do these activities?

The child will need to gain trunk rotation for many functional activities. The child must first learn to automatically use righting reactions to orient the body in space and later learn to modify those reactions in balance. Next, the child must develop head control in order to function independently in vertical activities. The child first was flaccid and now has extensor dominance: that is, total patterns of extension, not postural extension. Thus, the child does not have adequate flexion or postural extension. By placing the child on the knees of the PTA, the child will be in a flexor pattern and be looking down to facilitate postural extension with a tucked chin. Thus, both activities are needed.

2. Is the request within the domain of the PTA?

Yes, this is within the domain of the PTA. If the PTA is not familiar with the specific handling techniques, asking the PT to observe and help to correct body error is also very appropriate.

3. At what stage of motor learning is the child?

Stage 1.

4. What type of practice context would you choose? The response needs to relate to whole, pure-part, sequential-part, and whole to part to whole learning.

You would be mass practicing using the whole activities of rolling and head control, initially within a small range and then increasing that range to gain full function.

5. What type of practice schedule would you expect the PTA to use? When considering the practice schedule, what type of feedback would be used initially, and how would that feedback be changed as the patient improves?

Because the child is non-verbal, kinesthetic input (muscles, joints, tone of voice, and facial expressions) will be the input system or feedback given. Initially, the feedback will be extrinsic, but as the child learns, it will be increasingly intrinsic.

6. Why would you expect change, and what might it look like? When or why would you ask the PT to change the interventions delegated?

Given the age of the patient and the huge potential for neuroplasticity and motor learning, the PTA should expect the child to improve. The rate of this improvement is dependent upon the potential of the child, the environment around the child, the amount of repetitive practice the child is encouraged to do, and many other variables. The PTA is not responsible for recognizing all these components. That responsibility falls within the PT's practice parameter. Thus, the PTA should be told what variables or movement patterns to anticipate once learning has occurred and what movement responses are not desired. Both types of movement should alert the PTA to ask the PT to reassess the patient.

Case #2

The patient is a 5-year-old male who suffered an anoxic event due to drowning. Before the injury, he was an active, healthy child in kindergarten and doing very well. The child was in a coma for 1 week and in a vegetative state for 3 weeks. He is now stable and has been sent to neurorehab for physical therapy. The patient can roll and come to sitting although his trunk tone is reduced. He can sit independently as long as he does not have to move but cannot stand up from sitting. The PT has asked the PTA to first place the patient in sitting, the PTAs using his or her own leg to support the patient's trunk from behind, bringing the boy into a vertical postural pattern. The PTA is then to ask the child to reach for toys and hand them to his mother. Next, using a large ball, the PTA should roll the child into a vertical posture on his knees and then, using toys and manipulating the ball, the PTA should demand that the child maintain and/or regain upright posture during play.

Questions and Answers

1. Why has the PT asked the PTA to do these activities?

The patient's health status is normal, which means learning should lead to outcomes. The child has weak postural tone or power. He is not compensating with other patterns such as total extension now, but he might if given movement challenges beyond his ability to perform. He
has an impairment problem of power production of the postural extensor, which affects all functional activities. Thus, he needs to practice appropriate postural patterns before he is asked to use those patterns in functional activities. Postural muscles need to practice holding first in the shortened range (versus full range) extension due to the physiologic state of those muscles and their responsibility during dynamic holding (e.g., sitting) and movement (e.g., coming to standing or walking).

2. Is the request within the domain of the PTA?
Yes, this is within the domain of the PTA. If the PTA is not familiar with the specific handling techniques, asking the PT to observe and help correct body error is very appropriate. Similarly, if the PT asks the PTA to work on dynamic movement patterns such as gait, it would be inappropriate to ask a PTA to help the patient with dynamic movement requiring immediate and varied facilitation. This activity would require ongoing and immediate assessment and adjustment to correct the patient’s movement dysfunction. This assessment is the responsibility of the PT.

3. At what stage of learning is the child?
The patient is in Stage 3 of daily living motor activities, which is appropriate for a 5-year-old child as far as learning. Functional activities beyond his age may be affected, but regaining past functional skill is the focus at this time. Remember that he has previously learned most ADLs. His problem is weakness in the postural system that affects all functional movement. Now, his postural system is performing as if it were at Stage 1 because he is not running that program in any activity. His potential for relearning is probably higher than someone who is learning these motor programs for the first time.

4. What type of environmental context would you chose?
The patient’s CNS knows what is expected but does not have control over postural patterns. Thus, he needs to mass practice using whole to part to whole learning. The PTA has been delegated patterns that practice postural strengthening within a ROM. The PT should take on the more complex movement patterns that require postural stabilization during a movement itself.

5. What type of reinforcement schedule would you expect the PTA to use?
The PTA would need extrinsic feedback initially, using knowledge of performance. Once the patient begins to use intrinsic self-correcting feedback, knowledge of results should lead to higher motivation.

6. Why would you expect change, and what might it look like? When or why would you ask the PT to change the interventions delegated?
The patient is a child and showing signs of recovery. He has some postural tone, but it is not yet adequate to hold his entire body weight when perturbed off a certain distance from midline whether in sitting or kneeling. With repetitive practice in weight-bearing positions (i.e., sitting and kneeling at the moment), he should be able to pull adequate postural reactions due to existing function, neuroplasticity, and the environment that optimizes motor learning. Once the patient demonstrates automatic motor programming in the above-mentioned position, the PT will delegate controlled standing and possibly partial weight-bearing treadmill training. The same rationale will be used regarding why the activity needs repetitive practice with patient participation.

Case #3
The patient is a 27-year-old male who suffered a TBI following a head-on collision while driving his car without a seat belt. He has been in the ICU for 4 days and has been transferred to the rehab unit today. The PT has evaluated the patient. At this time, he is conscious but has extremely low tone. He is unable to come to sitting or standing independently, and he does not have enough tone to sit independently. The PT has asked the PTA to sit the patient on the side of the bed with the feet supported, first by raising the head of the bed, then guiding the patient into sitting. The PTA can either kneel behind the patient on the bed with a ball in the patient’s lap and the patient’s arms over the ball, or the PTA can sit in front of him and make sure his weight is forward over his pelvis with his arms on the PTA’s shoulder. The goal is to increase the length of time the patient is able to sit semi-independently. As the patient gains control and strength, have him begin to reach for real targets, such as a cup or ball, while maintaining trunk and pelvic
control. The goal is to increase the length of semi- or independent sitting. This is accomplished through the patient being challenged by perturbation of his weight over his hips during reaching.

Questions and Answers

1. Why has the PT asked the PTA to do these activities?

   The patient is stable and healthy but has developed functional limitations due to the TBI. If the activities delegated to the PTA are beyond the patient’s capabilities, he will compensate with other patterns and stereotypic movement, thus limiting his true functional return. Thus, the PT has delegated the responsibility of postural control in sitting with functional assistance using either the ball to keep the patient’s trunk erect or the shoulders of the PTA, with the patient’s arms at 90 degrees or above, to help facilitate postural programming. Due to the very low tone, other functional activities have not been delegated.

2. Is the request within the domain of the PTA?

   Yes, it is well within the scope of the PTA to treat this patient using these techniques.

3. At what stage of learning is the patient concerning sitting?

   Now, because the patient has lost so many programs (postural, balance, force production, movement patterns, etc), we can only assume that he is at Stage 1.

4. Is the PTA working on new learning or relearning an old program?

   Although this patient cannot perform independently, any functional activity he needs in order to relearn old programs is possible. The fact that he is an adult and mastered those movements before the injury would make prognosis of functional return promising.

5. What type of environmental context would you choose (quiet or noisy, hard or soft surface)?

   If the patient’s primary sitting environment is on a hard surface, then that should be the context within which you begin intervention. Due to the severity of the insult, beginning in a controlled, quiet stimulus environment would allow the patient to focus on learning. However, he must be progressed to a noisy, high stimulus environment before he can be considered independent. He would be mass practicing the programs as a whole activity.

6. What type of reinforcement schedule would you expect the PTA to use?

   Initially, the PTA will need to give extrinsic knowledge of performance feedback. The patient’s ability to maintain the position and begin to move away and back without extrinsic feedback would suggest that he is learning the programs and using intrinsic feedback from his own body to self-correct. At this time, knowledge of this result can be used.

7. Why would you expect change, and what might it look like? When or why would you ask the PT to change the interventions delegated?

   As soon as the patient can perform the described movement, and there is carry-over to the next session, the PTA needs to report to the PT, who then needs to reevaluate the program and adjust, as appropriate. For a young adult who has previously succeeded in ADLs, the return of independent performance should be expected, as long as the PT and PTA do not ask for performance that encourages abnormal movement. One precaution should be taken involving the affective or emotional domain of the patient following a head injury. Often, individuals with TBI have had limbic system sheering or frontal lobe damage and, thus, may have a difficult time controlling their emotions. If a clinician frustrates a patient, that patient may respond with inappropriate verbal or physical behaviors. If the PTA observes this behavior or feels threatened by the patient, the PTA should immediately ask the PT for guidance.

Case #4

The patient is a 59-year-old male with the medical diagnosis of Parkinson’s disease. He is able to do all functional activities at a certain rate, but he has great difficulty regaining his balance if he trips and difficulty initiating changes such as sit to stand and stand to walk. He especially complains of problems turning (eg, turning into the bathroom or turning and walking back to the dining room with his food). First, the PT asks the PTA to teach the
patient to use a partial rotation pattern when coming to sit versus the adult sitting pattern he is using. The PT also asks the PTA to have the patient practice going from sit to stand to sit on a variety of surfaces, with the chair or stool at a variety of levels. The PT delegates placing this patient on the treadmill, first at his normal gait pattern and then changing the settings to encourage fluctuation in walking speed and height of incline. The fourth task for the PTA is to create a maze for the patient to walk through that requires him to turn at each corner. Initially, he should be instructed to just walk, and then he should progress to walking through the maze facing a specific direction. Once he can do this independently, the activities will become his home exercise program, which he must practice in order to maintain function for as long as possible. Additionally, there are other activities the PT may delegate to the patient’s significant other or caregiver because the patient still needs to continue practicing but does not need a PT or a PTA to help with these functions at this time.

Questions and Answers

1. Why has the PT asked the PTA to do these activities?

   This patient comes to the PT with a chronic, progressive disease that affects the motor system and is on medications to assist with the distal tremor (if present at this time) and proximal rigidity. He is still functional, but the proximal rigidity is beginning to affect his movement capabilities. The PT asks that the PTA teach a partial rotation pattern when coming to sit. This decision is made in order to facilitate trunk rotation early in the morning or after a nap. This rotation will dampen the rigidity caused by the disease. Second, the PT asks the PTA to practice sit to stand on various surfaces and heights. This treatment is identified by his delay in reaction time when he tries to stand up or stops standing up or by his walking once he gets to vertical. Third, the PT asks the PTA to place the patient on a treadmill and then begin to vary the speed and incline. The PT delegates this task because the patient is able to walk but is unable to increase his speed if he loses his balance. The goal is to increase rate changes and walking environments to maintain functional skill. The fourth activity delegated is walking first through a maze and then through a maze while facing a specific direction. The patient complains of difficulty turning as he approaches the bathroom from the hallway. The maze training will encourage his ability to turn in any direction while walking using a feed-forward program. Similarly, as he begins to lose the ability to transfer one feed-forward motor program to another, the maze should help retain that skill and force changes in existing programs as he progresses walking through the maze.

2. Is the request within the domain of the PTA?

   Yes, the delegated tasks are appropriate for a PTA because the patient is still independent but needs guarding and control of this environment in order to maintain or regain function.

3. At what stage of learning is the adult concerning walking?

   The patient is at Stage 2: retention. He knows from a somato-sensory motor map what he is trying to do, but retaining the ability to control the motor system as environments change is difficult. This is one reason why therapists observe cognitive attention to motor tasks of patients with this diagnosis.

4. Is the PTA working on new learning or relearning an old program?

   First, the patient will be working to relearn; however, the PT may ask that the patient slightly vary the way he normally performs, hoping that he will use adjacent cell in the basal ganglia and, thus, retain/regain prior programs. If this does not work, then compensation must be taught, which will require mass learning and use of other sensory systems (eg, vestibular) and kinesthetic input with rotation.

5. Why did the PT select the specific environmental context, and why should it work?

   The environmental context will be mass, quickly move to intermittent controlled, and then move to random practice. Because the patient has a chronic, degenerative disease, designed therapy must be very functional and focus on movement patterns that are critical to quality of life of the patient. The clinician must remember that this degenerative disease will progressively take function away. Therapy goals are to regain some and maintain most functional programs for as long as possible. This means that using a whole program would be best, with the patient self-correcting with intrinsic feedback. The patient will
know whether he accomplished the movement or not by his own intrinsic feedback. Thus, knowledge of performance is used for correcting quality of the movement. Reducing this feedback as the patient self-corrects is important for long-term learning and maintenance of function.

6. What type of reinforcement schedule would the PTA expect to use?

You should expect the patient to show more rotation in the trunk during turning movements. In addition, the patient should be able to regain balance following perturbation due to his ability to change walking speed in different environments. Similarly, he may be more independent in coming to standing and standing independently and may initiate walking with less pausing.

7. Why would you expect change, and what might it look like? When or why would you ask the PT to change the interventions delegated?

You should expect positive changes because the PTA is optimizing the environment to relearn. The patient has a progressive disease, and that disease will slowly take away function. The therapeutic intervention may maintain or even regain needed function. If the patient can easily perform any of these tasks, the PT should be informed in order to reevaluate. If the patient is not showing signs of increased function after a few sessions, then the PT, again, should be informed because the tasks may be too difficult. Obviously, if the patient is losing function, the PT should be notified immediately.

Case #5

The patient is a 71-year-old male with the medical diagnosis of a mild right cardiovascular accident (CVA) with resulting left hemiplegia. He can sit independently but does not have equal weight bearing on the left hip. With assistance, he can come to standing with the majority of weight on his right leg. The PT has delegated to the PTA the activity of weight shifting in sitting. Specifically, the PTA is to have the patient reach with his right arm over to the left side as far as possible and increase that range as the patient improves. If he can use the left arm to do the same, then the PTA is to also include that extremity. Second, the PTA is to assist the PT in placing the patient in a harness in order to do supported weight bearing on the treadmill. Once the patient is in the position and the PT determines the pace and degree of body weight support, the PTA will be assisting the patient with his left leg in order to practice walking.

Questions and Answers

1. Why has the PT asked the PTA to do these activities?

Although the patient has a definite trauma to his CNS, the degree of neuroplasticity available following strokes is large. This patient already demonstrates a lot of functional skill following his stroke. The PT delegates automatic weight shifting during functional reach to enhance the patient’s ability to symmetrically sit and move on and off that position during reach. The PT selects a body-supported weight-bearing activity to allow the patient to practice programs that are available and running normally. In addition, the PT also demands that other programs be integrated into the activity, but at a level where success can be accomplished.

2. Is the request within the domain of the PTA?

Yes, this is within the training domain of a PTA. The sitting activity needs repetition of practice with an increase in the range of reaching and is an activity that PTAs are taught in school. Although some PTAs may not have learned supported treadmill training, these specific intervention techniques can be taught to the PTA by the PT. Moving the more involved leg while on a treadmill does require quite a bit of motor skill by the therapist. Practice by the PTA will enhance that skill and make the intervention more successful.

3. At what stage of learning is the adult concerning walking?

The patient is practicing impairment training and working on retention of the programs in one specific environment (sitting or walking on a treadmill).

4. Is the PTA working on new learning or relearning an old program?

In sitting, the PTA is working on retention. If the PTA is facilitating a normal gait pattern on the treadmill, the PTA is working on relearning an old program and, thus, retention. Encouraging the patient to circumduct, or hip
hick, means working on a new program and, thus, acquisition.

5. Why did the PT select the specific environmental context?

The specific seated environment is selected because the patient can sit independently but has limitations in weight shifting due to various impairments. The supported treadmill training is selected because it allows the patient to practice the walking program with the need to run balance and postural programs at a full power level. Mass practicing the whole program of sitting should lead to the quickest improvement. Mass practicing part to whole by beginning with a support for balance and posture and with assistance with stepping should allow the patient to progress. The PT determines a decrease in assistance and support. The patient will progress to independent ambulation on the treadmill. Next, the PT will change rate and incline and will progress to various surfaces.

6. What type of reinforcement schedule would you expect the PTA to use?

Reinforcement in sitting brings knowledge of results in reaction. The therapist can always praise the patient for weight shifting but, in reality, the shifting is happening automatically in the reaching task. Reinforcement in gait happens initially through knowledge of performance because various impairments are being taught. Extrinsic feedback will initially be great, and if the patient learns the programs (with or without kinesthetic input), he should be able to walk independently. If the programs are not accompanied with intrinsic self-correcting feedback, the patient will never be independent in all environments.

7. Why would you expect change, and what might it look like? When or why would you ask the PT to change the interventions delegated?

Very few patients will fail to gain function. Sometimes, there are other health, perceptual, and emotional impairments that affect outcome. The PT should determine those interactions, and the PTA should report if the patient is or is not improving. Most state laws require the PT and PTA to discuss the patient at least weekly; at this time, it is very important that the PTA identify change toward the desired goal. If the PTA sees any change in the functional level or health of the patient, that change should be reported to the PT.

CHAPTER 4

By Rolando Lazaro, PT, MS, DPT

CHAPTER QUESTIONS AND ANSWERS

1. What is the purpose of a neuromuscular examination?

The neuromuscular examination allows the identification of problems that can be appropriately managed through physical therapy intervention; identifies the interactions of various body systems as they relate to the patient’s signs, symptoms, and progress with rehabilitation; and protects the patient by identifying potential life-threatening or emergency conditions and/or the need to refer to other health care practitioners.

2. When is it appropriate for a PTA to be involved in the examination of patients with neurologic pathologies?

A PTA may be present as an extra set of hands to assist a PT in gathering objective data as part of an initial examination and evaluation. The PTA is more commonly involved in performing tests and measures to gather objective data as part of a reexamination for interim or discharge evaluations.

3. Which neuromuscular examination procedures may the PTA perform?

Vital signs; components of arousal, attention and cognition; sensation; muscle tone; MMT; goniometry; presence/absence of synergy patterns; presence/absence of developmental reflexes; coordination; balance; functional ability; and selected standardized tests and measures.

4. Describe the procedure for testing each of the following:

a. **Attention:** Ask the patient questions regarding person, place, time, and situation (eg, Who is the President of the USA? Where are you right now? What month and year is it? Why are you here?).

b. **Short-term memory:** Verbally provide a list of seven numbers or five to seven words to the patient, asking the patient to immediately repeat the list, then asking him or her to recall the list again after 5 and 30 minutes.
c. **Light touch:** Use a piece of cotton or the end of a cotton swab to lightly stroke the skin. Request from the patient, “Tell me when you feel me touching you.”

d. **Superficial pain:** Cut a tongue depressor in half so that there is a blunt and a sharp end, or pull apart a paperclip. Apply uniform pressure with each application of the stimuli. Alternate the sharp and dull stimuli randomly. Request from the patient, “Tell me whether you feel sharp or dull.”

e. **Proprioception:** Use a fingertip grip over the bony prominences of the lateral joint surfaces. Identify to the patient the words selected to identify the ROM positions to be used (eg, initial, mid-, or terminal range). Move the joint(s) through a ROM, and then hold it in a static position. Ask the patient to verbally describe the position or to duplicate the position of the joint(s) on the opposite limb.

f. **Stereognosis:** Place common items (eg, paperclip, keys, dice, coin) in the patient’s hand, and ask the patient to identify the object by touching and feeling it.

g. **Muscle tone:** The PTA moves the limb slowly and passively to feel for resistance to movement or lack of resistance. To assess spasticity, the extremity is moved at varying speeds, and resistance to movement is assessed again. The Modified Ashworth Scale can be used as a more objective assessment of tone.

h. **Romberg test:** Ask the patient to stand with feet together, with eyes open and then with eyes closed. A positive Romberg sign is noted if the patient is able to maintain the upright position with eyes open, but with eyes closed either loses balance or demonstrates excessive sway.

5. What are three tests that can be used to assess balance?

   - Romberg test
   - Sharpened Romberg test
   - The Clinical Test for Sensory Interaction on Balance (CTSIB)
   - Berg Balance Scale
   - Functional Reach Test
   - Performance Oriented Mobility Assessment

6. When documenting the amount of assistance a patient needs for a transfer, what does the term moderate assistance mean?

   *Patient expends 50% to 75% of the effort for the task.*

---

**CHAPTER 5**

*By Darcy Umphred, PT, PhD, FAPTA*

**CASE STUDIES**

**Case #1**

Mrs. Jones is a 78-year-old woman who has a history of falling. She does have a history of diabetes and knows she is to drink water once an hour. After MRIs, blood studies, and various other medical examinations, the MD could not make a definitive diagnosis regarding her falling. The patient was sent to physical therapy to determine if interventions might help. Upon the initial visit, Mrs. Jones had a black eye and informed the PT that she had fallen into her closet when she tried to get a shoe. After a thorough balance assessment, the PT determined that Mrs. Jones had all balance strategies, adequate ROM, and knew when she was falling. She used to swim daily with her friends at her senior living inside pool but had stopped after having an episode of pneumonia. During that episode, she stayed at her daughter’s apartment next to hers. During that time, she remained in bed the majority of the day for slightly over four weeks. She has become very inactive, lives in a small apartment, and only goes out when her daughter takes her to the doctor. She no longer drives, and her daughter does all her grocery shopping. She usually heats a microwave dinner in the evening and has cereal and fruit or cheese for her breakfast and lunch. Her daughter often brings a meal and eats with her. Mrs. Jones is weak, especially in her ankles, knees, and hips bilaterally. That weakness is especially true in her postural muscles in both legs and her back. She spends the majority of the day sitting in her rocking chair watching TV or reading. She has a large pitcher of water by her chair, which allows her to have her hourly glass of water. She also speaks in short sentences. She fatigues quickly during physical activity and has a slowed reaction time to perturbations. The PT has delegated five interventions to the PTA before a reassessment. The PT gave the PTA the following instructions:

1. Have Mrs. Jones practice getting up and down from her chair at least 1 time an hour
by telling her to go to the kitchen and get a
glass of water instead of using a pitcher by
her chair. Give the responsibility to Mrs.
Jones because she is independent in this
activity and has walls to stop her falling if
she loses her balance.

2. Have Mrs. Jones practice reaching for her
shoes and donning them:
a. First, in sitting from her chair: Session 1.
b. Second, in standing with a support arm
holding onto a table, a chair, or some
other stable piece of furniture: Session 2
and 3.
c. Third, in standing with a shoe directly
within her BOS: Session 3 and 4.
d. Fourth, in standing, have her shoe
sequentially farther and farther away
from her LOS. Progressing to reaching
into the closet by Session 5: progress
through this sequence as she increases
her tolerance to moving over her center
go of gravity without falling. She may prog-
ress faster or slower depending upon her
endurance and fear of falling.

3. Teach Mrs. Jones diaphragmatic breath-
ing:
a. First, while lying on her bed. Session 1.
b. Second, when standing or walking.
Session 2: count the number of syllables
she uses in a sentence at the beginning
of therapy and at the end. Document
and report those numbers to the PT fol-
lowing each session.

4. After you, the PTA, can walk with Mrs.
Jones a distance of 25 yards [distance to the
mail box and back], instruct the daughter
to walk with her mom daily to the mailbox.
The daughter should be told that the goal is
to increase that distance on a weekly basis.
The child was placed
initially in casts to maintain ROM and allow
healing. The casts have now been bivalved
and will be used as night splints. The child
has now been referred to the outpatient clinic
in order to regain functional use of his LEs for
gait. The PT has delegated strengthening exer-
cises of the gastroc/soleus muscles to the PTA.
The PTA is instructed to do passive stretching
to the ankles with a focus of gaining approxi-
mately 5 degrees beyond 90 degrees at each
session with the goal of gaining and maintain-
ing 110 degrees of ankle ROM for ambula-
tory activities. The PT also wants the PTA
to do strengthening exercises in patterns that
encourage the child to break up the extensor
synergy (+ supporting reaction) while incorpo-
rating ankle function both in weight-bearing
and nonweight-bearing. These activities can
be encouraged in sit to stand, side-stepping,
half kneel to stand, kicking a ball with one
foot while maintaining balance and support

2. What clinical symptoms would the PTA
want to immediately discuss with the PT?

The PTA should monitor BP, HR, and breath-
ing rate. If the patient ever shows stress, the
movement activity should be stopped. The PTA
should observe how rest affects the patient and
whether she recovers quickly. Because of her poor
breathing patterns, she needs to be monitored
closely in order to ensure the movement program
does not exceed her ability to oxygenate her body.
Obviously, any acute symptom such as pain
or immediate loss of muscle function must be
reported quickly.

3. Under which area of intervention does this
program fall?

The PTA will be primarily doing function-
al training, although specific breathing exer-
cise would be considered impairment training.
Although the PTA will be working on strength
or power building, this will be done during func-
tional activities and not as specific impairment
training.

Case #2

Charley is an 8 year old who was diagnosed
with cerebral palsy at 3 months of age. His
family has been told he has spastic diple-
gia. He was in therapy as an outpatient in a
developmental program until age 5 and now
receives physical therapy two times per week
while in school. Charley recently underwent
heel cord lengthening. The child was placed
initially in casts to maintain ROM and allow
healing. The casts have now been bivalved
and will be used as night splints. The child
has now been referred to the outpatient clinic
in order to regain functional use of his LEs for
gait. The PT has delegated strengthening exer-
cises of the gastroc/soleus muscles to the PTA.
The PTA is instructed to do passive stretching
to the ankles with a focus of gaining approxi-
mately 5 degrees beyond 90 degrees at each
session with the goal of gaining and maintain-
ing 110 degrees of ankle ROM for ambula-
tory activities. The PT also wants the PTA
to do strengthening exercises in patterns that
encourage the child to break up the extensor
synergy (+ supporting reaction) while incorpo-
rating ankle function both in weight-bearing
and nonweight-bearing. These activities can
be encouraged in sit to stand, side-stepping,
half kneel to stand, kicking a ball with one
foot while maintaining balance and support

Questions and Answers

1. Are these interventions appropriate to del-
egate to the PTA?

Yes, nothing that was delegated was outside a
PTA’s scope of practice.

on the opposite LE. The PTA is encouraged to play with the child over bolsters, where the child will have to maintain the LEs in external rotation and abduction when coming to stand. The child could be asked to bat a ball, hit a balloon, or catch a ball while increasing the muscle power to succeed at the task.

**Questions and Answers**

1. Are these interventions within the scope of practice of the PTA?

   Yes, *impairment training to increase strength and ROM is certainly within the scope of a PTA.*

2. How would the PTA document change in range and power of the LEs, and how is that affecting functional behavior?

   The PTA could measure ROM and strength changes using traditional measurement tools taught to them within an accredited PTA curriculum. Similarly, the patient could be asked to perform the sit-to-stand pattern as identified in the weeFIM. Increases in ROM and power building in the LEs will automatically affect the ability to go from stand to sit and vice versa.

3. Under which area of intervention does this program fall?

   The primary areas of intervention are in impairment training for joint ROM as well as strength building. If the PTA needs to manually control external rotation with abduction while the child moves from sit to stand, then that part of the program would be considered augmented intervention.

**Case #3**

The patient is a 28-year-old male who suffered a head trauma following an auto accident 10 days previously. No orthopedic or integumentary problems exist. The patient has a tracheotomy and is intubated for feeding. He lost consciousness immediately, and the paramedics had to resuscitate him following a cardiac arrest. He only was without O2 for 2 min, and the doctors do not anticipate any severe anoxic injury. The patient was only in ICU for 2 days and has been transferred to a sub-acute rehabilitation unit. The patient is in a persistent vegetative state, considered Level 3 on a Rancho scale. The PT is working with the patient on a ball in vertical in both sitting and kneeling to try to facilitate automatic postural trunk and head control. The PT has delegated ROM exercises to the PTA as well as horizontal rolling and bed mobility. The therapist wants the PTA to encourage rolling by handling from the LEs. Initial handling should begin with the patient in sidelying and facilitate both rolling toward prone and back toward supine. As the patient begins to automatically respond, the PTA is to increase the ROM of the rolling activity with the holds that the patient will begin to roll. The PT has instructed the PTA to work both in the patient’s bed in the morning and on the mat in the PT clinic in the afternoon. Following the PTA intervention, the PT will work on sitting and kneeling, with the PTA assisting by guarding the patient (controlling the roll of the ball) and encouraging interactions with the patient while in the patient’s visual gaze.

**Questions and Answers**

1. Are these interventions within the scope of practice of the PTA?

   Yes, passive ROM and augmented rolling activities are well within the PTA’s scope of practice. Similarly, assisting the PT by guiding and helping to control equipment, such as a large ball, is expected by both the PT and PTA.

2. What clinical signs would the PTA want to report immediately to the PT?

   Monitoring of vital signs and autonomic reactions would be an important aspect of this patient’s care. Any abnormal autonomic reaction such as profuse sweating, rapid increase in HR, or severe agitation with unknown cause should be reported to the PT immediately. Similarly, any seizure activity would indicate the need for immediate medical attention.

3. How would the PTA document change?

   The PTA could measure ROM in the hips, knees, ankles, and any other joint that seems to be abnormally hypertonic or hypotonic. The patient could be placed in sidelying, and the PTA could measure how long it takes the patient to roll onto his back or prone. The Ashworth scale for spasticity could also be tested by the PTA on joints identified by the PT, as long as the PTA developed the skill necessary to perform the test with reliability.
4. Under which area of intervention does this program fall?

The PTA and the PT are using augmented, hands-on, therapeutic interventions due to the low level of consciousness expressed by the patient. It is often hard to determine whether an individual has a locked-in syndrome where cognition is present, but the motor system is nonresponsive to either augmented intervention or conscious effort by the patient. The PT will be responsible for communicating those changes to the medical team, but the PTA may have perceptions regarding that issue and should share those perceptions with the PT. Often, a PT or PTA's first awareness is the feeling that the patient is assisting with some of the movement or intentionally resisting some movement patterns. The PT or PTA can check his or her proprioceptive perception by placing the patient in an optimal position to assist with some movement pattern and then asking the patient to assist. Even if the patient does not understand the command, if he or she can and desires to assist, active movement by the patient will be seen and felt. This can be a huge turning point for neurorehabilitation.

Case #4

Patient is a 58-year-old female who suffered a left CVA 2 weeks ago. She is a CEO of a large corporation and suffered her stroke following a 22-hour air flight. She was returning from a business trip to East Asia. She has minimal speech involvement and has functional motor use of her right UE and LE; however, she has significant loss in sensation. She has normal sensation in her face, trunk, shoulders, and hips but has poor proprioception in her right knee and ankle and no proprioception or tactile sensation in her right elbow, wrist, or hand. She is right-hand dominant. Due to the poor sensation, she is unable to use proprioception to anticipate a perturbation, which could cause a fall in standing or during ambulation. She uses her visual and vestibular system to compensate for poor proprioception, but when distracted in standing or during ambulation, she is slow to react and tends to fall. She has automatic protective extension in a feed-forward UE movement, but without vision, has little idea where her arm is in space or whether her hand is functionally doing anything. The PT has delegated to the PTA various UE sensory awareness exercises with the patient with and without vision. The PT has instructed the PTA to:

- a. Have the patient hold various objects first in the left hand and then in the right. The patient is first asked to look at the object while it is in the left hand, manipulate it, and then visualize what it looks like.
- b. Have the patient first find an object (spoon, marble, comb, sand paper, cotton, etc) in sand and rice with visual assistance. Then perform the same activity without vision. If she cannot perform this activity initially, tell her what the object is, then have her look at it, shut her eyes, and visualize the form while manipulating it.

The PT was doing sensory awareness retraining first in supine, moving to sitting, and ending in standing in order to facilitate bilateral integration and better somatosensory cortical awareness. Once the patient had some awareness of the right LE, the PT delegated to the PTA bilateral LE weight-bearing activities. The PTA was instructed to:

- a. Have the patient practice rocking on her feet visualizing the symmetrical movement at both ankles.
- b. Have the patient practice weight shifting onto and off of the right LE. Then shift to the same activity on the left.
- c. Have the patient begin ambulation on a hard surface while visualizing the movement in her right LE. Once she acknowledges that she feels her right LE, the PT should be told in order to begin gait training in various sensory environments.

Questions and Answers

1. Are these interventions appropriate to delegate to the PTA?

PTAs are educated to assist and do sensory training once delegated that intervention. All interventions discussed in the case study are well within the PTA's skill. If the PTA has obtained additional training in such techniques as “Feldenkrais” (Chapter 14), the therapist may ask the PTA to introduce some of those practices during the intervention process.

2. What clinical symptoms would the PTA want to immediately discuss with the PT?

Any acute onset of organ system problems (eg, chest pain, breathing difficulty, acute left shoulder pain, nausea, vomiting, increased numbness, or confusion) should always be reported immediately. As this patient probably threw a
clot due to stress and flying, she is at higher risk for pulmonary embolisms than other patients. The PT should alert the PTA to these potential complications before beginning intervention.

3. How would the PTA document change in the areas of intervention?

The patient does not have motor limitations but has movement dysfunction due to sensory loss. Thus, measurement of changes in sensory perception will be the goals for documentation. Two-point discrimination, sharp/dull sensation, and position-in-space tests could all be delegated to the PTA as part of ongoing documentation during interventions. Placement of the LE for gait consistency could be measured with a force-plate if the PTA knows how to use that apparatus. To accurately measure change and recovery, the PTA may have the patient walk on compliant and consistent surfaces and then measure the number of accurate responses to perturbation and the number of potential falls.

4. Under which area of intervention does this program fall?

The fourth area of intervention was stressed within this case study. The patient needed sensory awareness and processing training. Although the processing training emphasizes the sensory training and remapping, the intervention also needs to be implemented as part of functional training to assist the CNS in organizing and remapping the sensory system following a central vascular insult.

**CHAPTER 6**

*By Gordon Burton, OT, PhD*

**CHAPTER QUESTIONS AND ANSWERS**

1. What are the six stages of adjustment discussed in this chapter?

   *Shock, anxiety, denial, depression, anger/hostility, and adjustment.*

2. What is the difference between engagement and disengagement?

   *Engagement leads to adjustment, and disengagement is maladaptive.*

3. Is adjustment a static stage that can be reached and maintained?

   *Adjustment is a dynamic process that is always being reassessed.*

4. What are the commonalities between client adjustment and PTA adjustment?

   *All people are adjusting to life at all times.*

5. Why should two clients be treated differently even if they have the same diagnosis?

   *Each person has a different motivation, spiritual connection, and set of goals; thus, each should be presented with treatment in a unique way.*

**CHAPTER 7**

*By Kris Corn, MS, DPT*

**CASE STUDIES**

**Case #1**

TC was born 2 months premature. During labor, his mother experienced a drop in BP. At birth, he was diagnosed with kidney dysfunction, and at 9 months of age, he underwent surgery to correct the problem. At 16 months of age, he was diagnosed with CP, only after his mother repeatedly asked the pediatrician about her concerns. He was first diagnosed with diplegia; however, the PT determined that this child’s motor deficits included his trunk, both legs, and one arm (triplegia). At 18 months of age, he began physical therapy. At the time of evaluation, he lacked adequate head control, had no trunk control, and could not bear weight on his LEs. When placed in standing, his LEs pushed into the support surface, which stimulated the positive support reflex, thereby producing extension, adduction, and internal rotation of the LEs with the feet plantarflexed and inverted. The left UE was held in flexion, and the neck was hyperextended. Following 6 months of treatment, once weekly, and a home exercise program performed daily, he was able to be placed in sitting and maintain this position independently while perturbing his COG during play. He began rolling over in both directions, creeping on all fours, pulling...
up onto his knees, and began attempts to pull to stand. When he began therapy, there were minimal vocalizations. Following 6 months of intervention, he had multiple vocalizations and a vocabulary of 30 words due to improved posture and motor control that directly affected respiration, phonation, and articulation.

Physical therapy interventions included the following:

• Altering postural tone.
• Increasing trunk extensor tone for postural control.
• Increasing trunk flexor tone for stability and mobility.
• Repetition of newly acquired motor skills is necessary in order to develop function or motor learning.
• If the child requires immediate intervention and facilitation, the PT may choose not to delegate treatment to the PTA. Once the child begins to demonstrate some internal motor control, the PTA could work on all of the above within that skill, working to the outer limits to allow the child the opportunity to practice, self correct, and develop normal patterns of movement.

Questions and Answers

1. What positions or postures would you consider using with TC? Consider that his trunk tone is low while his three extremities demonstrate high muscle tone. 

   **Sidelying:** Making sure his head and neck do not drop or push back into cervical hyperextension, bring the neck into flexion. Gently rock his body forward and backward as a unit. As his tone decreases, add rotation by taking the shoulder girdle forward and the pelvic girdle backward and then reversing this movement.

   **Supine:** Bring the UEs into flexion/adduction and the LEs into flexion/abduction at the hips and the knees.

2. Once postural tone is closer to normal and facilitated movement can be freer and easier, would you chose an activity that is gravity eliminated or gravity resisted? 

   *Gravity resisted activities.*

3. Trunk extension must be balanced by trunk flexion. List three ways that you would develop trunk flexion strength.

   - Weight shift his COG posterior to activate the abdominal muscles while:
     - Sitting him on your lap facing you
     - Sitting on a ball, bouncing

4. Determine one functional posture in which you would place TC, and explain what activity you would use to encourage repetition.

   *Swinging in an appropriately supported swing that provides sufficient trunk control so he could practice head righting and trunk strengthening.*

5. When is it appropriate for the PTA to change or advance the child into new movement patterns?

   *It is never appropriate for the PTA to change a child’s therapy program unless instructed otherwise. If the child progresses faster than expected or if some designated technique does not create the desired normal reaction, the PTA should consult the PT for further instruction on where and how to advance the child’s therapy program. Neither the PT nor the PTA should encourage a child to practice an abnormal or incorrect motor pattern when alternatives are available.*

Case #2

JS and his twin sister were born 1 month prematurely, delivered by emergency cesarean section because his heart rate dropped during his mother’s nonstress test. At birth, he weighed 3 lbs, 5 oz, and he sustained an anoxic/ischemic event. He remained in the neonatal unit for 1 month, going home 1 week later than his twin, who had no complications. At 12 months of age, he was diagnosed with CP. He received some therapy initially after he was diagnosed. At 2.5 years, his family moved to another state, where he received physical therapy and ST for 2.5 years. At the time of evaluation, in their new location, he presented with severe motor involvement as well as sensory dysfunction. All sensory systems were involved, which negatively influenced the motor system and caused severe increase in muscle tone, irritability, and fear of movement. Increased muscle tone interfered with all movements of the extremities as well as the oral and facial muscles, impacting eating and sound production for speech. He did not have head or trunk control and could not be placed sitting or standing. He had no speech but communicated with crying.
He received intensive therapy consisting of physical therapy 3 times weekly and speech therapy one time weekly in a private clinic. Emphasis was placed on decreasing his extensor tone, increasing or maintaining ROM, developing postural tone and control, increasing strength, and facilitating normal movement patterns. His motor control improved after 2.5 years of therapy; he was independent in sitting on the floor and in an appropriately fitting chair. He could pull himself to standing and maintain the upright posture to play. He could communicate verbally but lacked sufficient respiratory support for loud sound production. His left UE was used for playing, manipulating toys and objects, and feeding himself, while the right UE minimally assisted. He attended a regular kindergarten with the assistance of an aide. He rode in a therapeutic horseback-riding program once a week, where he gained further strength and postural control. JS's therapy has continued; his therapy will be ongoing until he is no longer making progress towards his goals both medically and educationally. As children grow and mature, it is essential that they receive therapy to help them achieve their full potential.

Questions

1. During JS’s initial therapy sessions following the evaluation, the PT could delegate to the PTA incorporating sensory integration activities into intervention and functional skills such as swinging, spinning in a hammock, and bouncing on a ball in prone or sitting.

What motor behaviors would a PTA be looking for during therapy that would indicate the child is improving?

As a child begins to integrate information from his many senses, there can be a wide variety of responses; however, all the responses are directed towards helping the child to:

f. Improve social interactive abilities.

g. Increase tolerance to movement.

h. Decrease effort required to move.

2. The PTA can work on increasing flexor and extensor postural tone to facilitate head and trunk strength and control. This can be done in sitting while on a hard surface or a ball and progressing to kneeling, half-kneeling, and standing.

How would the PTA use therapeutic tools such as a ball, bolster, a swing, or one’s knee to facilitate this control? How would a PTA progress the child within an identified activity in order for the child to have greater internal control?

The bolster is often the best choice initially between a bolster and a ball because it moves in only two directions and is, thus, easier to control. The ball allows greater variety of movement but is more difficult to control. The child’s position on the ball can be prone, supine, sidelying, or sitting depending on whether the child has increased extensor tone, decreased postural tone, or decreased ROM. Sit the child on the bolster or ball when there is sufficient tone to permit this posture. In sitting, the PTA may be facilitating trunk extensors by shifting the ball forward to provide adequate upright posture and then moving the ball backwards to facilitate trunk flexors. Once both groups of muscles are activated and the child is responding to movement, a combination of forward, backward, side-to-side, and eventually diagonal movements are facilitated to develop strength, stability, balance, and endurance.

3. Between 2 and 6 months of initial treatment, JS’s increased tolerance for processing sensory information permitted better organization of the motor system. He was less irritable, less fearful of movement, and he began to develop some head control. He was able to hold his head upright with neck elongation for 30 to 60 seconds. He began reaching for objects with his right UE that previously was held in flexion at the shoulder, elbow, and wrist. At this point in his therapy, the PTA could be responsible for developing strength in the cervical and shoulder girdle musculature to promote good head control. This can be done by placing the child in a mechanically aligned sitting posture both on a hard and a compliant surface. With support on his
trunk, weight shift him slowly, causing his COG to shift outside of his BOS (anterior and posterior and lateral). Apply compression down through the shoulders, and then move to the hips. Then use the hips as the pivotal point to cause perturbations. Only perturb the BOS to the limit of the child’s ability.

How would the PTA know if the perturbations were too hard? What would the PTA look for in the child’s behavior that would suggest the perturbations were creating appropriate learning?

The PTA would know that the child was receiving too much input when the child no longer demonstrates good postural alignment and control. The head/neck may hyperextend; the spine collapses into a thoracic kyphosis, falls backward into extension, or falls forward into flexion. If appropriate learning were taking place, the child would be able to maintain an upright posture with adjustments in the alignment and may express pleasure at being successful to the challenge imposed.

4. During this phase, the PTA could also be responsible for developing head-righting reactions in sitting. Support the trunk appropriately using control from the shoulders, mid-trunk, and hips. Weight-shift him in all planes. The LEs are inhibited from moving into flexion, adduction, and internal rotation during these activities by controlling the legs at the hips and thighs.

What motor behavior by the child would the PTA use to know that the intervention was progressing in a positive direction? Why might noise or sudden movements by other individuals cause the child to lose control?

As the child increases postural strength and control, the child will tolerate movement that takes the COG further outside the BOS while maintaining good alignment. If the perturbations are too forceful, the child will compensate using abnormal patterns of movement and possibly, by crying because of fear of movement he or she cannot control. If the child no longer is frightened by the weight shift, he or she may actually enjoy movement for movement’s sake.

5. During this phase, the PTA could also be responsible for developing strength and stability of the UEs. While prone in weight-bearing, weight shift him initially on forearms, and then go to extended arms as strength will permit. Initially, work on non-compliant surfaces on an angle off vertical, and work toward horizontal. As the child’s strength and stability improve, move to compliant surfaces.

Identify two motor behaviors exhibited by the child that would help the PTA know the goals of strength and stability of the UEs are being met.

As the child’s postural strength and stability improve, the child’s UE would move away from midline, moving out towards abduction and external rotation (equilibrium/balance responses and/or protective responses), while the other arm may reach for something. Protective responses occur first forward, then to the child’s side, and eventually backwards.

6. During this phase, the PT could increase the respiratory capacity through manual trunk mobilization, and the PTA can be responsible for maintaining the mobility through sidelying and gentle rocking. Then, the PTA can follow with functional activities requiring blowing, sucking, and voicing.

What techniques might the PTA use to increase respiratory capacity?

Increasing respiratory function can be achieved by mechanically stretching the intercostal muscles. The therapist’s hands are placed on the lateral aspect of the child’s trunk, following the direction of the ribs; the ribs are then brought gently but firmly down and in, moving with the child’s breathing pattern. The lower costals may be held in this position, thus demanding that the upper costals move upward and expand and bringing increased airflow into the lungs. If a speech therapist is on staff, this is often the best individual to consult concerning respiratory function. CAUTIONS must be emphasized that the movement is firm, slow, and gentle (without much force, thus avoiding any possibility of tissue tearing or fractured ribs).

7. Between 6 and 12 months of physical therapy, JS’s head-righting had emerged and head control was developing. The PTA could be responsible for developing trunk rotation. Rotate the shoulder...
girdle and/or the pelvic girdle around the vertical axis in sidelying, prone, supine, and sitting postures. Use an activity that requires rotating first to one direction and then to the other. The body will follow the head in a righting reaction, which allows the child to move more freely. Creating an environment where the child is playing will motivate greater self-control and motor learning. For example, place a toy on one side of the child so that he has to reach to pick it up, and then rotate to the other side to complete the activity.

What motor behaviors by the child would clue the PTA that the PT needs to reassess and potentially change the program?

The PT may need to reassess a child when the child is able to successfully rotate, reach, and play with a toy or engage in an activity. The PTA should now be advanced in skill acquisition. If the child is not successful in rotating and reaching, there may be structural or tonal limitations that must first be addressed.

8. During this phase, the PTA could be responsible for developing transition skills from supine to prone to sitting as well as transition through various sitting postures available to him. Postural tone close to normal with proper alignment is necessary in order for movement to occur as fluidly and normally as possible. Guide him with as little or as much assistance as is necessary to help him achieve the movement successfully. As the child improves, slowly reduce the assistance while having the child still succeed at the activity.

Why is the previous sentence a clear indication that motor learning and control is in progress?

The ultimate goal in therapy is for the child to be able to move independently. In reaching this goal, the child will gradually require less intervention by the therapist. As the PTA gradually allows the child to control his/her posture and movement against gravity, first with assistance and gradually without assistance, the child learns and the therapist becomes successful with treatment.

9. During this phase, the PTA could be responsible for developing strength and stability of the shoulder and pelvic girdle muscles by positioning in prone on forearms or in weight-bearing on all fours or on hands and feet. Initially, place the child on elbows in prone and weight shift from side to side. The child's head should be stabilized (as if a turtle was poking his head out of a shell). The PTA must make sure the child is not only resting on his joint structure instead of using his own muscle power. When a child only uses positioning to remain on elbows, it will look as if his head was down in a shell and little postural control will be seen within the shoulder girdle. Once the child can hold with perturbations and begin to weight shift on his elbows, the PTA can use a toy to encourage reaching with one arm while supporting on the other. This activity can also be done on extended elbows or on all fours.

What would the PTA look for to make sure the child is gaining strength and greater stability?

As strength and stability improve, there are several aspects of the child's posture and alignment that change to indicate there are improvements:

a. The lengthening of the cervical spine is sustained with or without movement.

b. The lumbar spine remains extended, a lordosis is not observed because the abdominal muscles are active.

c. The child's hand can be placed flat on the support surface with wrist hyperextension because there is now sufficient extensor strength that does not require a total extensor pattern of the arm (finger, wrist, and elbow extension) to maintain an all-fours posture.

d. Weight shift, first anterior/posterior then lateral, is possible while in the all-fours posture.

**Progression of PTA Intervention:**

**Case #2**

Once most of these activities are developing and there is increased strength and mobility, the following activities are also delegated to the PTA:

- Increase cervical and upper thoracic muscle strength by placing him:
  
a. In prone, on forearms, and while playing and weight shifting.
  
b. On extended arms while reaching and playing.
In prone on a scooter board, platform swing, or suspended in PTA's arms while moving him through space.

- Develop trunk-righting responses by:
  a. Rolling in all horizontal position.
  b. Sitting on a lap, ball, or roll as a quiet sitting activity or during play.
  c. Swinging with trunk support. Use an appropriate swing that provides adequate support or, while the child is sitting on the lap of the therapist during the swinging activity, support the child at the pelvis and allow the child to respond to the imposed movements.
  d. Carry him facing away from the caregiver and with his hips on the caregiver's hip, thus encouraging the child to sit up and interact for extended periods of time.
- Develop active trunk rotation around the vertical axis in sitting by having the child:
  a. Swing a bat or racket.
  b. Sit or straddle a roll while reaching and touching his feet or picking up objects off the floor with both hands (to one side and then to the other).
- Teach transitional movements (i.e., supine to sitting, rolling, all fours, knee standing to half-kneel, coming to standing from the floor or a chair, and facilitating gait by handling at the hips or shoulders):
  a. Supine to sit using diagonal movement patterns, which would be considered a partial rotation pattern from supine to sit.
  b. Moving the child from prone to all fours, handling from the hip. From prone, handling should guide the pelvic girdle back over the knees while encouraging the arms to weight bear.
  c. From side-sit, either have the child come up to or pull to knee standing; weight shift in kneeling. Then rotate the pelvis to encourage one leg to come into half-kneeling. Work or play in half-kneeling so the child weight shifts onto one leg and off the other. Then, have the child come to stand off the half-kneeling leg. Guidance can come from either the back at the hips or the front at the shoulder girdles, arms, or trunk.
- Increase standing balance while engaging the UEs in play by:
  a. Cruising on the furniture or wall
  b. Standing while drawing.
  c. Catching and throwing a ball, Frisbee (Wham-O Inc, Emeryville, Calif), etc.
  d. Riding a bike.

Chapter 9

By Claire Beekman, PT, MS, NCS

Chapter Questions and Answers

I. John, age 22, sustained a C6 level SCI, ASIA A, in a motor vehicle accident 2 months ago. He was a student at a local community college studying computer science.

1. What muscles remain innervated?
   
   The muscles that define neurological level C6 are the radial wrist extensors and the clavicular portion of the pectoralis major. By definition, these muscles must be at least Fair plus (F) in strength. Muscles innervated at higher levels—the deltoid, biceps, sternocleidomastoid, scalenes, trapezius, and diaphragm—must be of Normal (N) strength. Because a single neurological level (C6) was given, muscles on both sides of the body must meet or exceed the minimum strength requirements. All muscles below those innervated by C6 will be absent (unless there is a zone of partial preservation). Muscles innervated at the C7 level may demonstrate Trace (Tr) or Poor (P) strength.

2. Will he be able to continue using his computer?
   
   John should be able to continue to use his computer, although he will need to strike the keys one at a time.

3. What kind of adaptive equipment will be required to use the computer?
   
   In order to use his computer, John will use the tenodesis provided by his wrist extensors to generate a pinch. He can use a typing aid of the slip-on variety or attached to a universal cuff or an orthosis so he can more precisely and forcefully hit the keys. John may benefit from a wrist-driven wrist-hand orthosis (WDWHO), which transfers power from the wrist extensor muscles to the fingers for prehension. The OT will evaluate the need for and effectiveness of these assistive devices. The PT and PTA will assess and modify his w/c sitting position to optimize computer use.

4. The PT has identified sliding board transfers as a goal for the patient. What activities or interventions would you want to initiate before attempting transfers?
Before initiating sliding board transfers, John will need to work on a variety of skills, including sitting balance and UE strengthening. To balance in the short sitting position, the patient must be able to balance his body using his neck and arm muscles. Remember that he lacks both muscles and sensory feedback in his trunk, LEs, and hands. In addition, he must be able to extend his shoulders, elbows, and wrists backwards to catch himself if he starts to fall. The PTA may note that the patient lacks sufficient extension ROM in the UEs (shoulders, elbows, and wrists) and will discuss the need for stretching exercises with the PT. It is helpful if the PTA can demonstrate to the PT the extent of the problem so that the PT can determine if stretching exercises are appropriate. Because the patient does not have triceps muscles, it will be very important to maintain full elbow extension, which then allows him to lock his arms for a depression lift. The fingers must remain flexed during all UE weight-bearing activities to protect the tenodesis he will use to operate his computer. The PTA can progress sitting balance from static sitting while using the arms to dynamic sitting without using the arms. One of the most difficult components of a sliding board transfer for patients at this neurological level is getting sufficient trunk flexion to unweight the buttocks. John will feel extremely vulnerable about falling forward because of his motor and sensory losses; yet, if he is unable to lean forward enough, he will not be able to lift his buttocks and move to the side. The PTA should focus some time and effort on giving the patient more confidence in his ability to assume the forward-leaning position. Practice of in-place depressions on the mat using blocks of various sizes or practice in the w/c using the w/c armrests can facilitate gains in strength and the patient’s confidence. During initial trials of sliding board transfers, blocks can facilitate adequate lifting.

5. What kind of w/c will he probably need, given his vocational goals?

The most appropriate w/c would be chosen based on a variety of factors, including the patient’s level of injury, patient goals, and patient resources. Studies have shown that patients at neurological level C6 are at a disadvantage when propelling a manual w/c, even an ultralight manual w/c. Compared to other persons with SCI, persons with a C6 injury propel at a slower velocity, have a higher energy cost per distance traveled, and have difficulty with even slight uphill grades. Therefore, if John used a manual ultralight w/c, he would be investing a lot of his time and effort in merely getting around and might not have the reserves for other activities. Because John has indicated that he will continue with his schooling and that he plans to eventually obtain a job, we would recommend a power w/c of sufficient durability to get him around campus and in the community. John should be able to do an independent depression or forward pressure relief and, if that were the case, he would be able to manage with an upright power w/c. If he needed to rest during long periods at the computer or was unable to do independent pressure relief, a power-recline or tilt mechanism could be ordered. Ideally, the PT would work with a vendor so the patient could try different types of w/cs before a decision is made. Another factor to be determined before finalizing the w/c decision would be whether John had a way of transporting the power w/c. He will need a manual w/c as a backup if something happens to his power chair. If an ultralight w/c is chosen as his backup chair, he could propel the w/c for “exercise,” but this chair is more expensive than a lightweight w/c. The choice between an ultralight and a lightweight manual w/c might depend on his financial resources.

II. A patient is on the tilt table having his hamstrings stretched to gain ROM for a straight leg raise. His injury level is T2. He starts sweating and complaining of a headache.

1. What do you suspect has occurred?

I would suspect that the patient has autonomic dysreflexia (AD). AD can occur in persons with a SCI at T6 and above, and this patient’s injury is at T2.

2. What should you do first?

First, I would put the tilt table down and take his BP.

3. If his BP is elevated, what should you do?

If his BP is elevated more than 20 mm Hg over his resting level, I would loosen his clothing and check the leg bag, get him into the sitting position, and take the BP again. If the BP goes down, I would let him rest and then return him to the medical unit, reporting to the appropriate nurse and doctor. If the BP does not go down, I would contact the nurse or doctor and request assistance in accordance with the hospital’s policy. Since AD is a medical emergency, the PTA should know how to take care of the situation and should know the hospital’s procedure. The PT should be informed as soon as possible so that he or she can follow-up with the medical staff and make changes in treatment, as needed. The PTA should not reinstitute the same treatment without discussion with the PT.
III. You are working with a patient with a SCI at L1 level, ASIA C, which he sustained 2 months ago. You know that the doctor has talked to the patient about recovery and the level of his injury. The patient now has Poor minus (P−) to Poor (P) strength in the hip flexor and quadriceps muscles and Trace (Tr) in his dorsiflexor, hamstring, and hip abductor muscles.

1. Is it important to continue to strengthen the muscles in his LEs?
   Certainly, we should encourage the patient to work on strengthening exercises, while avoiding predicting the strength or function that might be achieved. Questions about prognosis should be addressed by the physician. To determine how much the patient understands the information the physician presented, the PTA can ask the patient to restate what he or she has been told by the doctor. If the patient seems unclear about what the physician has said, the patient should be referred back to the physician for clarification. Patients sometimes ask everyone the same question, hoping that someone’s answer will support their hopes or to manipulate team members. The PTA should carefully avoid putting himself or herself in the awkward and unethical position of discussing prognosis with the patient.

2. Can he get stronger?
   Based on averages for persons with traumatic SCI, muscles in the P or Tr range at 2 months should continue to increase, although not to normal strength. It is important to remind the patient that everyone’s outcome is different and that studies are averages.

3. Would he still benefit from exercise if it were 13 months post injury? Why?
   It is unlikely that a significant increase in strength would still occur at 13 months, although there might be factors that would result in an atypical outcome. If the PT has requested that the PTA perform LE strengthening exercises on this patient 13 months after injury, it would be appropriate for the PTA to clarify the expected outcome of the strengthening program, if the PT has not already communicated this. The purpose and outcome of the intervention should always be clear, to assure the desired outcome.

IV. You are asked to work with a patient who has T6 paraplegia and is sitting on a gel cushion. Yesterday was his first day sitting, and he had no problems with dizziness. The PT asks you to implement an education program on pressure relief and prevention of pressure sores.

V. You are running a class on power w/c mobility for patients with C2 to C5 tetraplegia.

1. What points would you want to cover with this patient?
   An educational program on pressure relief and prevention of pressure sores would include the following:
   - Description and causes of pressure sores. An analogy of the blood vessels with a garden hose and how a lack of blood supply relates to pins and needles can be helpful.
   - Where pressure sores occur and how they are related to the patient’s position (eg, supine, sitting, sidelying).
   - Factors about the patient’s diagnosis, such as difficulty moving and lack of sensation, that increase the risk for sores.
   - Other factors that contribute to the formation of pressure sores, such as wrinkles in clothing, wetness, and shear.
   - How pressure relief is achieved (through cushions and mattresses) and removal of pressure (by turning and doing sitting pressure relief). The PTA would need to demonstrate one or more techniques of pressure relief and help decide on the most appropriate one(s) for the patient at that time. The PTA should have the patient demonstrate his ability to do pressure relief and to do it for the appropriate amount of time. This patient could probably achieve pressure relief by doing a depression lift with supervision or an independent forward lean.
   - What the patient needs to know about his particular cushion.
   - Although the emphasis during this session would be on sitting pressures, it is important to help the patient recognize that all positions and activities put him or her at risk for pressure sores. Remember that this is the first of many times that the PTA will discuss this topic with the patient. Limiting the amount of information to something the patient can retain and use right then is more important than covering everything the patient needs to learn over the period of rehabilitation.
• Maneuver in tight spaces and around objects.
• Go up and down ramps.
• Drive on narrow straight areas, such as narrow sidewalks.
• Enter and exit doorways.
• Cross a street at a light.
• Drive in a safe manner, including around other people.
• Turn the w/c on and off.
• Operate special features, such as the tilt or recline.

2. What additional activities would be important if it were a class for patients using manual w/cs?
   In addition to the above, a patient in a manual w/c would need to be able to do the following:
   • Do a wheelie.
   • Go up and down stairs with assistance.
   • Go up and down curbs.
   • Do a floor to w/c transfer.
   • Get the w/c in and out of a car.

VI. You are working with a patient with T7 paraplegia.

1. What functional activities would you work on in preparation for a car transfer?
   Before attempting car transfers with a patient with T7 paraplegia, the PTA would want to make sure that the patient has good sitting balance and is able to perform a competent transfer to and from bed, mat, and other surfaces. Car transfers are more difficult than most other transfers because of limited space, the inability to match the w/c and seat height, the larger space between the w/c and the car, and other factors. The PTA is also less able to help the patient because of limited space. Trying the transfer first with a sliding board is always a good idea if the patient’s ability is even slightly in question. Following a successful sliding board transfer, depression transfers can be practiced immediately or at another session.

CASE STUDY

Social History. The patient, Randy, is a 26 year old male who is married and has two children, ages 3 and 5. The patient sustained a T9 complete SCI (ASIA A) when he fell off a roof while assisting in a family project to reroof his cousin’s house. Use of alcohol was not implicated in his fall. He has worked for 8 years assembling parts for an electronics company. He lives in a one-story home, which he rents and which has three steps to enter. There is no rail. The bathroom is rather small and has a tub. His wife is a homemaker and takes care of the home and the children. He does the yard work on weekends. He has a large extended family and many friends from work. They are putting on a fund-raiser for him and visit him frequently in the hospital.

Medical History. At the time of his fall, he sustained no other injuries except for some bruises on his arms. The thoracic spine fracture was diagnosed by x-ray, and no surgery was required. He was placed in a thoraco-lumbo-sacral orthosis (TLSO) for 6 weeks. When the TLSO was discontinued, the physician cleared him for all functional activities, with no limitations. He had no pre-existing medical problems.

Rehabilitation Center. Randy was then referred to an inpatient rehabilitation center. Upon admission to the rehabilitation center, he was screened for the presence of deep venous thrombosis; none was found. Each of the team members evaluated the patient; the physician wrote medical orders for care and established the neurological level of injury as T9, ASIA A. Critical components of the rehabilitation program, including bowel, bladder, and skin care; increasing the patient’s time out of bed; and initiating self-care and mobility, were implemented immediately while plans were made for the entire rehabilitation stay.

Physical Therapist Evaluation: The PT evaluated the patient and found the following:

Strength:
UEs = Normal (N)
LEs = Zero (0)
Trunk = Intercostals intact; abdominals absent except for those innervated by T8

Sensation (sharp or dull, light touch, proprioception):
UEs = Normal (N)
LEs = Absent
Trunk = Normal through T8; absent below

ROM:
Within functional limits, except for straight leg raise (SLR), which was 60 degrees bilaterally.

Functional capabilities. Previously, the patient had been independent in all functional activi-
ties. At the time of evaluation, he required moderate assistance for rolling in bed and coming to sit using the hospital bed rails, maximum assistance of one person for all transfers, and was independent for w/c propulsion on level terrain for short distances. When the PT initially got the patient out of bed into a w/c as part of his initial evaluation, the patient experienced some dizziness, which resolved within the treatment session.

Arterial BP: 118/78.

HR: 70.

VC: 60% of normal.

Mild spasticity in the plantar flexor and adductor muscles, bilaterally and not interfering with function.

**Patient Goals.** The patient wants to be able to take care of himself, return to work, and take care of his family. He also wants to be able to walk again.

**Discharge Goals.** Physical therapy discharge goals are: independence in depression transfers to all surfaces, except the floor, for which he will require moderate assistance; independence in bed mobility and achieving the prone position in bed; independence in all w/c skills except stairs; and independence in knowledge of all aspects of his care. Specific information that physical therapy is responsible for teaching includes basic w/c maintenance, care of the cushion, performance of self-ROM, and sitting pressure relief. Other disciplines have established goals of independence in bowel and bladder care, skin management, independence in bathing and self-care.

**Physical Therapy Program.** The PT has not identified a respiratory program for this patient. Randy’s VC is already 60% of normal and his inspiratory muscles are intact. Based on research and experience, the PT anticipates that Randy’s VC will return to previous levels by participating in the transfer training, w/c propulsion, and UE strengthening activities that are a part of his rehabilitation program.

**The PT has identified the following program for Randy:**

**UE strengthening exercises.** Although Randy’s UE muscles test as N, he will need “super-normal” muscles to substitute for his LEs. The goals for strengthening the UEs will be accomplished by putting Randy in an UE exercise class designed specifically for patients with SCI.

**Transfer training and functional activities.** The PTA will be responsible for these activities. The PTA will progress Randy through transfers to and from the bed, mat, toilet, car, shower or tub, floor, and other surfaces, as needed and usually in that approximate order. The PT will also identify when Randy is ready to perform depression transfers. He may have a transition period when he is still using the sliding board for some transfers, such as the car, but is doing a depression transfer to other surfaces, such as the bed.

Randy is accustomed to being proactive in his work and solving problems that occur at work and home. Because of this attitude, he is always trying to figure out how to do his transfers more easily and to set up the environment to his advantage. This kind of behavior is critical in self-sufficiency and in solving problems that will arise after discharge and should be fostered. During the rehabilitation process, Randy is asked to make decisions about his care, to help determine the course of his program, and to prioritize goals.

The PTA will also work on functional activities, including sitting, rolling, coming to sit, scooting, and w/c skills. There is overlap in functional activities and transfer training. For example, sitting balance is critical for scooting, moving in bed, doing w/c activities, and for doing transfers. When the patient can get into the prone or semi-prone position with pillows protecting bony prominences, he can reduce the amount of turning that he must do at night and can, therefore, reduce the amount of assistance required. Proning for 1 to 2 hours is initiated during physical therapy treatment and is then carried over by nursing and Randy himself.

Randy has tight hamstring muscles. The PT has asked the PTA to oversee the stretching on the hamstring stretch apparatus and to assess the patient’s progress daily.

**Patient education about various aspects of his care.** In addition to the education provided by the different health care disciplines involved in the patient’s care, many rehabilitation centers provide classes for patient education on topics including how the body works after SCI, status of research in SCI, community resources, how to interact with w/c vendors, sexuality, and other topics. In addition, education of the family is important. This patient’s wife will be a great resource to him and needs to be educated about all aspects of his care. Because Randy’s wife will be an important support,
she is included in training, including transfer training before he leaves the hospital.

The PT will consult with the patient about a w/c. All patients with complete injuries benefit from an ultralight w/c. A variety of ultralight w/cs are available, each with specific features. Factors, such as whether Randy will transport the w/c in a car, whether he will return to work, and what his insurance will allow, will be considered. If possible, Randy should try a variety of ultralight w/cs before making a decision. The PTA will work with Randy on the basics of w/c maintenance, such as how to fix a flat tire and how to adjust the wheel camber, casters, and brakes.

The PTA will train the patient on w/c skills and teach the patient how to get the w/c in and out of the car.

Evaluation of the home environment. The PT and PTA should also discuss with Randy his home layout and coordinate with other disciplines for equipment Randy will need, such as a raised toilet seat, bath bench, and grab bars. They will also discuss the need for a home visit. Even though Randy can skillfully and independently perform his transfers and has good problem-solving skills, he has identified the small size of the bathroom as a potential problem. Based on this potential barrier, the PT or the PTA will make an on-site visit, typically with the OT, to come up with the best solution to bathroom access. From the beginning of Randy’s stay, other equipment needs, such as a ramp, were discussed so that everything would be available at the time of discharge. Randy’s father and brother made a ramp according to specification given them by the PTA. Near the end of his rehabilitation stay, Randy is scheduled for a day pass on Sunday and an overnight pass the next weekend so that he has an opportunity to test his skills away from the hospital and at home. Any problems that are identified can be dealt with while he has easy access to the hospital resources.

Questions and Answers

1. What muscle groups should be emphasized?

Muscle groups emphasized will be the muscles most vulnerable to fatigue during w/c propulsion: external rotators, elbow and shoulder extensors, and scapular stabilizers.

2. What kind of transfers will the PTA begin with?

Sliding board, because the patient requires maximum assistance at this time.

3. What activities will be compromised by his lack of 90 to 110 degrees SLR?

He will have difficulty with all activities performed in the long sitting position, including scooting, doing LE dressing in bed, floor transfers, “bumping” up stairs on his bottom, and moving around in bed or on the mat in the long sitting position.

4. When would the PTA stop stretching to gain SLR?

When the patient has achieved the degrees of SLR, ideally 100 to 110 degrees, determined by the PT in setting up the program; when increase in motion has reached a plateau, which the PT should be aware of because of daily feedback by the PTA; the PT has decided to terminate the activity; or there has been some problem that requires termination of the SLR.

5. Would you expect to need to be concerned about autonomic dysreflexia with this patient?

No. This patient’s injury is T9. This is lower than T6, which is the lowest level at which AD is observed.

6. What specific education would be covered by physical therapy?

Knowledge about the basics of w/c maintenance, care of his cushion, getting in the prone position; skin care and pressure relief; how and when to perform self LE ROM. Many rehabilitation centers provide classes for patient education on topics including how the body works after SCI, status of research in SCI, community resources, how to interact with w/c vendors, sexuality, and other topics. In addition, education of the family is important. This patient’s wife will be a great resource to him and needs to be educated about all aspects of his care.

7. What would this patient need to know about his cushion, pressure relief, skin care, and LE ROM?

Cushion: How to take care of the cushion, how
long should it last, and what he should do if problems occur.

**Pressure relief:** What method and frequency of pressure relief in the chair has been established for him, for what period of time he can be in the prone position, so he will not have to be turned so often.

**Skin care:** Description and causes of pressure sores, positions that put him at risk, why he is at risk for sores, factors that contribute to the formation of sores, the purpose of the cushion, how to check the skin, and what to do if a sore occurs.

**Self-ROM:** When and how often to do LE ROM and any precautions the PT or PTA have identified. Because Randy's wife will be an important support, she is included in training, including transfer training, before he leaves the hospital.

8. What w/c skills would the PTA work on with this patient?

*Propelling the w/c over smooth and rough terrain, up and down ramps and curbs; maneuvering in tight spaces and around objects; entering and exiting rooms; crossing a street; doing a wheelie; and going up and down stairs in the w/c with assistance.*

**Final Results**

Randy underwent a four-week rehabilitation program. During the first week, the physician discussed the prognosis of his injury. He indicated that while it is impossible to know with certainty what the outcome would be, most people with his kind of injury did not have recovery of muscles or the ability to walk. Randy was sad about what the doctor had said, but ready to move forward with learning how to take care of himself. During the second week, a meeting was held during which the team discussed questions the family had about Randy's discharge. The psychologist met with Randy to help him deal with the injury and plan for the future. By the end of the second week, Randy was dressing himself, doing his self-care, learning tub and toilet transfers, doing a depression transfer to the bed and mat, and doing his own self-IC. Nursing was working with him on morning skin inspection and extending the time between catherizations, so he would not have to do IC so often at night. He was also attending daily multi-disciplinary classes. His SLR was still limited, but modifications were made by all disciplines in activities he performed in the long sitting position. By the third week, he was transferring to the toilet with assistance for his bowel program, transferring with assistance and a tub bench to a tub for showering, transferring to the car using a sliding board, and proning half the night. During this week, he had a small setback when he developed a bladder infection. He was lethargic, had a fever, was sweating, and missed a day of therapy. A few days of treatment with antibiotics cleared the infection, and he was able to return to therapy even before the infection completely resolved. Despite the infection, he was able to go on an overnight visit and identify problems that were resolved on the home visit the next week. His SLR reached 100 degrees.

By the end of the fourth week, Randy was ready to go home: able to perform most of his care independently. He and his wife had learned a great deal about taking care of him and were able to identify resources for when problems arose. He had achieved all the goals that the PT established for him. In addition, Randy had accomplished most of the goals he had set for himself. He was not able to walk, although he was looking forward to trying to walk with orthoses and crutches in the future. He was not ready to return to work yet, but he has a job waiting for him that can be performed, with slight modifications, from a w/c. His fellow-workers are looking forward to his return. He has a great support network in his family and friends, and this will be important to his life. His life has changed, and some aspects will never be the same. He and his wife (and the children) are adapting to his injury and the life-style changes it will bring. He will still need to be followed for potential medical problems and will need to continue to have emotional and psychological help as he adapts to his changed life.

**CHAPTER 10**

*By Dennis Klima, PT, MS, GCS, NCS*

**CHAPTER QUESTIONS AND ANSWERS**

1. What are some of the medical complications that occur following TBI?
Medical complications may include an escalated ICP as well as the presence of a skull fracture or hematoma. In addition, patients may develop seizure episodes. Patients can also sustain other complications during their injury, such as fractures and internal organ damage.

2. What are some types of strategies that can be utilized in gait training for a patient with cognitive impairment who also has a LE weight-bearing restriction?

Patients with cognitive impairments and concomitant orthopedic weight-bearing restrictions often require the assistance of two people for this activity during therapy sessions. Patients may initially have to begin at the parallel bars to ensure proper gait sequencing and precautions for very limited distances. The PTA should structure intervention sessions so that the patient is optimally alert for gait and transfer activities. Fatigue and/or agitation periods will hinder functional training programs. The PTA must also be cautious not to assume that a patient has “learned” to ambulate or transfer with a weight-bearing restriction when carry-over for new learning is impaired.

3. What are various safety precautions that must be maintained when treating a patient whose behavior is consistent with Rancho Level IV?

The PTA should ensure that other personnel are immediately available in the treatment area to offer assistance, if needed. All staff must be familiar with emergency code procedures, which initiate a silent “show of force” gathering to diffuse a hostile behavioral event. The PTA should be competent in securing and unfastening any required restraint or protective devices.

4. What is meant by the terms coup and contre-coup injury?

The coup injury refers to the initial site of injury following TBI, whereas the contre-coup injury refers to the rebound area of impact.

5. What are important intervention considerations for the patient with post-traumatic seizures who is taking Dilantin?

Patients taking Dilantin should be monitored for potential side effects that occur with this anticonvulsant medication. Side effects may include periods of confusion, nervousness, and gait ataxia. The PTA should immediately report any of these observed findings to the supervising PT.

CHAPTER 11

By Jim Smith, PT, MA and Becky McKnight, PT, MS

CHAPTER QUESTIONS AND ANSWERS

1. Explain the differences between ischemic stroke, hemorrhagic stroke, and TIA.

Ischemic stroke occurs when there is a loss or interruption of the blood supply to a portion of the brain. An example is an atherosclerotic blockage of an artery that supplies blood to the brain, resulting in permanent damage to the brain tissue. A hemorrhagic stroke, also called intracranial hemorrhage, is the result of the rupture of a blood vessel in the brain, which results in blood flooding into the surrounding tissues. A TIA is temporary symptoms such as unilateral extremity weakness or sensory loss, visual disturbance, or difficulty with functional tasks. The cause is an interruption in blood supply to the brain that resolves within 24 hours accompanied by a full recovery from symptoms.

2. Describe how apraxia may limit a person’s ability to perform functional tasks.

Apraxia is a developed impairment in the performance of a task that is not the result of the loss of strength, coordination, sensation, or from a deficit in communication. The person with apraxia is capable of moving effectively but lacks the cognitive ability to initiate, organize, or sequence the movements necessary for completion of the task. The functional deficits vary widely depending on the unique characteristics of each patient, and examples include the inability to comply with a request to lie down on a bed, consistently putting clothes on inside-out, drinking from an empty cup, attempting to cut one’s food with a spoon, or the inability to use a toothbrush.

3. Identify the data that should be collected when providing interventions to a patient who has diminished cardiopulmonary capacity.

The data that should be collected include HR, respiratory rate, BP, and perceived exertion. In some situations, the oxygen saturation and the presence of arrhythmias should also be monitored for safety.

4. Define the following:

a. vertigo: an illusion of motion resulting from a disturbance in the perception of vestibular sensations.
b. **disequilibrium**: a sense of imbalance resulting from a disturbance in the perception of vestibular sensations.

c. **ataxia**: impairment in the coordination of movement in which the movements are often described as consistently inconsistent.

d. **hemiparesis**: weakness involving either the right half or the left half of the body.

e. **unilateral neglect**: an unawareness of one side of the body and/or environment, such that the individual is unable to report or recognize sights, sounds, and/or touch opposite to the side of the brain affected by stroke.

f. **anosognosia**: an unawareness or denial of a neurological deficit, such as weakness and the functional limitations that accompany that impairment.

g. **aphasia**: a deficiency or complete loss of the ability to communicate and may include impairment of expressive (speaking) ability, receptive (comprehension) ability, or both.

h. **dysphagia**: a disorder of swallowing, and among individuals who have had a stroke, it may result from incoordination or weakness of the muscles involved in swallowing.

i. **homonymous hemianopia**: blindness involving the right half or left half of the visual field of both eyes.

j. **learned nonuse**: Following a stroke, an individual may have difficulty using a limb due to weakness or incoordination. The performance of a task with that limb will be difficult and slow, resulting in negative reinforcement for the use of that limb. When she or he compensates by using the contralateral limb for the task and is successful, she or he will tend to continue to perform tasks in that manner. The negative consequence is reinforcement for not using the limb, and as the behavior of learned nonuse develops, the individual ceases to use or attempt to use the limb.

5. Explain why shoulder pain is a concern following stroke, and describe strategies to prevent the development of shoulder pain.

   The development of shoulder pain following a stroke can be severe and cause distress and functional limitations. It is common and can develop in a majority of the persons who have hemiparesis following a stroke. Therefore, prevention is important. The strategies to prevent the development of shoulder pain include the following:

   • A positioning program and the use of a sling or other device to support the extremity.

   • A cuff support that encircles the humerus and suspends from the upper trunk and opposite shoulder.

   • When seated, the arm can be supported in an arm trough attached to a lap tray.

   • Preservation of flexibility about the shoulder joint through passive ROM.

6. Explain what pusher behavior is following stroke, and identify strategies to intervene to correct this behavior.

   Pusher behavior is evidenced by a seated or standing person leaning or actively pushing away from upright and toward the side. This person will resist correction by a caregiver and, when moved towards upright, will perceive that they are falling. Corrective interventions include focusing the patient’s attention on her or his posture by using available sensations (vision, vestibular, or proprioception) and awareness of the supporting surface. Techniques may include using a mirror, training sitting balance on a firm surface, and providing practice at detecting errors in perceiving upright.

7. Identify the data collection techniques that a PTA may use to identify and document a patient’s functional limitations, balance, and endurance when implementing the PT’s plan of care for a patient who has had a stroke.

   Documentation of the data collected about **functional ability** often includes a description of the patient’s ability based on the descriptors from the Functional Independence Measure (FIM). Timing the performance of a task, such as using a stopwatch to time ambulation speed or the number of sit-to-stand transfers that can be completed in 10 seconds, is also effective in identifying changes in function in response to interventions. It is also important to identify the environment in which the task is done because a patient’s ability is affected by things like the walking surface or the presence of obstacles.

   The ability to maintain an upright posture should also change in response to interventions, and the PTA should use components of the **balance** measurement tool used by the PT. Examples include the Timed Up and Go, Berg Balance Scale, Functional Reach Test, and unipedal standing time.

   Data about **endurance** should contain information about the amount of exercise and the patient’s physical response to the exercise. For example, documentation should identify the amount of activity, such as ambulating a specific distance or ascending a flight of stairs, and the response, such as measures of HR, respiratory rate, BP, and/or oxygen saturation.
8. Describe strategies to enhance the effectiveness of patient-related communication and instruction with a patient who has had a stroke.

Strategies to enhance communication include using simple, concise instructions; moderating (normalize) the patient's level of arousal when communicating; minimizing environmental distractions; confirming comprehension before increasing the complexity of the demands placed on the patient; and discussing goals and using exercise interventions that have relevance to the patient.

9. Describe therapeutic exercise interventions to enhance motor learning, the remediation of movement or function, and to increase aerobic capacity following stroke.

The therapeutic exercise interventions used to enhance motor learning or remediate functional abilities should provide preparation and practice for the unique functional demands of each patient. Choosing exercise interventions should be based on the following strategies:

• Practicing tasks and activities which are relevant to the patient.
• Applying movement progressions appropriate to task.
• Facilitating learning by fostering successful performance of the task while making it sufficiently challenging.
• Progressing attentional demands from fewer to greater.
• Using extrinsic feedback to augment performance, and advancing by fading the feedback.
• Progressing the practice demands from (1) a simple to a more complex environment, (2) stationary to moving tasks, (3) tasks which are consistent to those with variety, and (4) tasks with no manipulation to tasks which require manipulation.
• Progressing the amplitude of movement that occurs, the velocity of the movements performed, or the amount of work being performed.
• Reducing the assistance provided by the PTA or reliance on an assistive device.

Frequent physical exercise should be a component of the therapeutic exercise interventions to increase the patient's aerobic capacity. Provision of sufficient aerobic challenge often involves upright activities that engage large muscle groups for increasing periods of time, such as can be achieved through gait training, stair climbing, etc.

10. Identify the role of neuromuscular electrical stimulation (NMES), body-weight support during gait training, and constraint-induced movement therapy (CIMT) as interventions for the patient who has had a stroke.

NMES can be used to increase movement strength or to decrease spasticity. For example, NMES can be applied to the supraspinatus and posterior deltoid muscles of the shoulder to reduce glenohumeral joint subluxation.

Partial body-weight support during gait training involves gait training while the patient is suspended in a harness that supports a portion of the person's body weight. This allows the patient to practice the task of walking without the risk for falling and with a reduction of gait deviations.

CIMT involves restraining the less-involved extremity for a period of 14 days, during which the patient participates in massed practice of training activities and tasks using the involved limb. This intervention can increase the amount and quality of movement in the involved limb as well as the use of the limb for functional tasks.

Case Studies

Case #1
A 64-year-old gentleman was admitted to an acute rehab facility six days after having a CVA, which was diagnosed as a left internal capsule infarction. The patient displayed mild right extremity and trunk weakness. The patient also displayed diminished sensation throughout the right extremities. He demonstrated impaired balance and motor control and required minimal assistance for gait activities due to apraxia. The patient required constant verbal cues when ambulating and became easily distracted in cluttered environments or when other individuals walked past him. He had poor insight into his deficits and demonstrated impulsivity that placed him as a safety risk. The patient previously lived alone in a home with five steps to enter, and his goal was to return to that environment. The PT’s plan of care called for therapeutic exercise to improve strength and motor control, gait training on level and uneven surfaces, and patient education.

Questions and Answers

1. List the impairments, functional limitations, and disabilities this patient demonstrates.
Impairments: right extremity weakness, trunk weakness, diminished sensation in right extremities, impaired balance, impaired motor control, and cognitive deficits (anosognosia, impulsivity).

Functional limitations: dependence for gait activities (minimal physical assistance and verbal cues).

Disabilities: currently unable to return to independent living.

2. Within the plan of care, what activities could be used to address the right LE strength deficits? What parameters would be utilized (frequency, intensity, etc)?

Circuit training, weight machines, free weights, and isometric exercise could be utilized to address the right LE strength deficits. Frequency and intensity should be 1 to 3 sets of 10 to 15 repetitions (15 rep max) of 8 to 10 exercises.

3. This patient demonstrates safety issues during gait due to motor apraxia and anosognosia. How do you want to progress the environmental context in which this patient is practicing gait activities?

Therapy activities should begin in a simpler environment with few distractions (eg, a quiet therapy gym) and progress to more complex environments. For example, at the beginning of this patient’s rehabilitation, the PTA may choose to schedule the patient in the therapy gym at a time of day when few other individuals are around and, as the patient improves, change the time of the therapy session to one where the gym is more active.

4. Discuss feedback strategies to utilize related to the patient’s functional mobility deficits.

At the beginning of this patient’s rehabilitation, the PTA should provide plenty of extrinsic feedback, including knowledge of performance (feedback regarding the patient’s quality of movements related to his apraxia) and knowledge of results (feedback related to the outcome of his movements, especially related to safety issues for this patient). The PTA can also encourage the patient to process his intrinsic feedback by asking the patient to assess his own quality of movement and outcome of the activity.

5. Utilizing the concepts of movement sequencing, discuss other postures and activities you might choose to utilize with this patient to address the deficits of motor apraxia noted during gait.

Taking the concepts of functional movement and variation in sequencing (since this patient is having difficulty with balance reactions and apraxia with gait), the PTA might choose to utilize a modified plantigrade position to increase the patient’s BOS and to perform LE activities designed to focus on controlled movements of the right LE and on maintenance of standing balance.

6. What observations would you make to determine if the PT intervention strategies being used are effective with this patient?

Strength changes in the right extremity and trunk; balance and motor control during gait; and amount of assistance (including verbal cues) required during gait.

Case #2

A 72-year-old female was on vacation with her sister when she had a left middle cerebral artery CVA. She was transported from her hotel room to the hospital via an ambulance. The patient displayed strength of 0/5 throughout the right UE. The patient had sufficient strength to initiate the movements of hip extension and adduction but demonstrated severe weakness and decreased tone throughout the left LE musculature. The patient required maximal assistance with all mobility, including rolling, supine to and from sit and sit to and from stand transitions, as well as transfers from bed to and from the w/c. When standing, she needed maximal assistance and a hemicane and was unable to support weight through her right leg. The patient’s sitting balance was diminished, requiring minimal to moderate assistance to maintain an upright posture. The patient demonstrated mild pusher behavior and required frequent verbal cues to shift her weight to the left. The patient also demonstrated global aphasia. She did not attempt to speak and only communicated with head nods and shakes. The speech therapist’s notes indicated the patient had only 50% accuracy with head nods and shakes. The patient was able to follow simple commands with physical and visual cues with 90% accuracy.
Discharge plans are for the patient’s son to come and assist with transporting the patient back to her hometown, where she will enter an acute rehabilitation unit. She will travel by commercial air. The son will need to be taught how to transfer the patient from a w/c into and out of a car and needs to practice a simulated transfer from a w/c into and out of an airplane seat.

Questions and Answers

1. List impairments, functional limitations, and disabilities this patient demonstrates.

   **Impairments:** 0/5 strength in right UE; weakness in right LE musculature; decreased tone in left LE musculature; diminished sitting balance; global aphasia.

   **Functional limitations:** assistance required with all mobility, including rolling, supine to and from sit, and sit to and from stand, as well as bed to and from w/c transfers.

   **Disabilities:** unable to complete vacation with sister; unable to travel home independently via commercial air.

2. Describe how this patient will need to be positioned when sitting in a w/c.

   The patient will require a leg rest to support the right LE as well as a lap tray or trough to support the right UE. The patient should be monitored to see if she maintains her trunk in midline; if not, lateral supports would be appropriate.

3. Discuss how you will approach this patient in relation to her aphasia.

   Utilize simple commands with plenty of visual and physical cues. For example, provide a demonstration of all exercises and activities.

4. Describe activities that can be utilized to help facilitate the patient’s use of her right leg.

   To facilitate the patient’s use of her right LE, it would be important to choose simple, functional tasks and focus physical cues to the right LE. An example might be choosing to do bridging activities in supine while providing facilitation techniques to the hip musculature.

5. Discuss what parameters would be appropriate when addressing transitional movements (variability, components of movement, etc).

   For the beginning of this individual’s rehabilitation, blocked practice and part-task training would be most appropriate; maintaining a simple environment free from distractions would be helpful. It would be important to explain to the son how the patient’s aphasia will affect his mother’s ability to participate with any transitional movement. The son should be instructed to take his time and make sure to set up the environment and equipment before initiating the transfer (positioning of w/c; leg rests removed to keep from tripping over them; remove arm rest on side moving to). It is important to instruct the son in appropriate body mechanics and transfer techniques. Since the patient will need to transfer both toward the stronger side as well as toward the weaker side, it will be important to be sure the son is instructed in techniques for both.

6. Detail the approach you will use when teaching the patient’s son how to assist the patient in transfers.

   The education session should begin with the PTA demonstrating a standard bed to chair transfer, emphasizing the importance of correct body mechanics to ensure safety and reduce the chance for injury to the patient or her son. The PTA will demonstrate the proper setup of the w/c, including positioning of the chair, locking the brakes, and removing the leg rests and arm rest on the side closest to the patient. The first transfer that should be instructed would be transferring toward the patient’s stronger side. Since the patient requires maximal assistance with transfers, the patient’s son should practice the transfer with the PTA or another health care provider acting as patient first. This will allow the son to practice the transfer technique without the fear of injuring his mother. Every detail of the transfer should be outlined: utilization of a gait belt, making sure the patient has shoes on, placement of the patient’s feet for the transfer, how to block the patient’s knee during the transfer, monitoring or supporting the weaker arm during the transfer, scooting the patient forward in the bed before initiating the transfer, how to keep the patient’s body weight close.
during the transfer, and providing both verbal and visual cues to the patient so she knows what is happening and so she is able to participate as much as she can. Once the son has practiced and demonstrated an appropriate technique using a “pretend patient,” he should attempt the bed to w/c transfer with his mother. The PTA will be located behind the patient between the bed and the w/c to be in a position to assist, if necessary. After the son demonstrates the ability to safely perform this transfer, then he should be instructed in the differences that will occur when transferring the patient toward her weaker side. Next, the son should be instructed in car transfers. Additional cues important for car transfers include assisting the patient into the front passenger’s seat, having the seat scooted back and the back of the seat reclined slightly to allow for more room for the transfer, and making sure to sit the patient in the seat, then bring her legs into the car. Finally, setting up a simulated airplane and practicing transfers from w/c to a seat on an airplane should occur.

- This approach relies on a part to whole and blocked practice approach. Other motor learning approaches could be outlined. Details related to utilization of a gait belt, w/c set up, instruction in body mechanics, and practicing different transfers should be discussed.

### Chapter 12

By Rolando T. Lazaro, PT, DPT, GCS

#### Chapter Questions and Answers

1. What are the common signs and symptoms of PD, MS, and ALS?

   **Individuals with PD may show bradykinesia (extreme slowness of movement), rigidity, resting (nonintentional) tremors, postural instability, and festinating gait. With MS, patients may complain of weakness; decreased sensation, balance, or coordination; tone abnormalities (spasticity); as well as difficulty performing ADLs. Individuals with ALS may demonstrate weakness, incoordination, difficulty in respiration, fatigue, problems performing ADLs, and abnormalities with sensation and tone.**

2. What are common intervention strategies a PTA may use when working with patients with PD, MS, or ALS?

   Common strategies may include the following: aerobic and endurance conditioning and reconditioning; balance, coordination, and agility training; flexibility exercises; relaxation; neuromuscular education or reeducation; gait and locomotion training; and ADL training.

3. Why is rotation an important intervention when working with patients with PD?

   Rotation decreases the tone of the axial musculature, thereby decreasing trunk rigidity, and opens a window that will allow the patient to perform movements that are more normal and functional. Rotation can be done supine in bed in the morning (lower trunk rotations) before the patient gets up, in sitting throughout the day, and in standing, as long as the patient is safe in this position. Rocking also decreases tone.

4. What are two “clinical pearls” that can assist a PTA when working with patients with PD?

   Encourage the patient to participate in group exercises. Group exercises allow the patient to engage in social activities, talk to other individuals who may have a similar condition or situation, and improve flexibility, strength, and endurance. Incorporation of visual imagery may assist in motor performance, whether contraction or relaxation. Teaching the patient to visualize being “strong and stable like a tree” may assist in improving standing balance; also, visualization may assist in relaxation (“imagine that you are relaxing in your favorite place…”).

5. What precautions should you take during treatment sessions when working with a patient with MS?

   Fatigue and overheating.

6. What are four “clinical pearls” that can assist a PTA when working with patients with MS?

   Encourage the patient to achieve optimum health and well-being. Along with the goal of maintaining the strength of the unaffected muscles to compensate for loss of strength of other muscle groups, encourage the patient to maintain a high overall level of fitness. Watch out for fatigue and overheating. Improve balance and coordination. Normalize tone (decrease spasticity) before training for functional tasks. Compensate for impaired sensation by teaching the patient to do frequent skin checks for skin breakdown, to use appropriate footwear when walking, and to be cognizant of situations where lack of protective sensation may be dangerous (cooking, taking a bath, walking on uneven surfaces, etc). Adapt the
environment, and use appropriate orthotic appliances to protect the joint and to improve function and safety. Discuss with the supervising PT the need to refer the patient to appropriate the medical professional, as necessary.

7. What interventions can you use to optimize the cardiopulmonary function of patients with ALS?

Examples include diaphragmatic breathing exercises, assisted cough (as necessary), and postural exercises to maintain optimal trunk alignment, which is important in efficient breathing. More complex equipment and intervention may be necessary in some patients, such as those in the more advanced stages of the disease; a referral to a physician and a respiratory therapist may be appropriate.

**CASE STUDIES**

**Case #1: Parkinson’s Disease**

MG is a 72-year-old male who was diagnosed with PD 12 years ago. The client resides in an independent living facility with his wife. The environment provides the client with a wide spectrum of social interaction and cognitive challenges as well as good access to health care. MG is cognitively aware of his surroundings and the effects of his illness. He cites unsteadiness when walking and dressing, poor night vision, and occasional drooling as symptoms he experiences.

The client currently takes Sinemet and Mirapex. The subject reports that he experiences freezing episodes when his medications wear off. As a result, he and his wife carefully plan outings around peak medication times. The client reports increasing difficulty with ambulation and ADLs such as transfers, dressing, and bathing. The client also reports increased falls in the past several weeks. He is afraid that he might sustain severe injuries following a serious fall in the future.

The client presents with a stooped posture, rounded shoulders, and thoracic kyphosis. He ambulates to the department with a festinating gait. He also presents with pill-rolling tremor at rest. He transfers from the bed to the mat with minimal assistance. Functional mobility testing shows that the client is independent with bed mobility but requires minimal assistance to sit from the supine position. He requires minimal assist to perform sit to stand. Sitting balance is Good, while standing balance is Fair. ROM is within functional limits to all four extremities. Patient demonstrates weakness in his bilateral LEs. Patient demonstrates trunk rigidity. The patient scored a 17/28 in the Tinetti Balance and Gait tests, indicating risk for falls. The patient scored 6 inches in the Functional Reach test, and this also indicates a risk for falls. The Berg Balance test was also administered, and the patient scored a 38/56, also indicating a risk for falls.

**Questions and Answers**

Identify the following:

a. Impairments and functional limitations presented.

Abnormal posture (stooped, rounded shoulders, and thoracic kyphosis); abnormal ambulation (festinating gait); pill-rolling tremor at rest; difficulty with transfers (requires minimal assistance). Needs assistance with functional mobility (requires minimal assistance to sit from the supine position, minimal assist in sit to stand); decreased balance (sitting balance is Good[F], standing balance is Fair[F]); bilateral LE weakness; trunk rigidity; at risk for falls (17/28 in the Tinetti balance and gait tests, 6 inches in the functional reach test, and 38/56 in the Berg balance test).

b. Potential interventions that can be performed by the PTA to assist in improving the patient’s functional performance.

Postural exercises to improve posture; therapeutic exercises (including trunk rotation) to decrease tone; gait training to improve ambulation; incorporating imagery to assist in motor performance; use of music and rhythm to decrease freezing episodes; and functional mobility training (transfer training, sit to stand training, and balance training) to decrease risk of falls. Also, encouraging the patient to participate in group exercises and perform a home exercise program.

**Case #2: Multiple Sclerosis**

P is a 45-year-old female who was diagnosed with MS 5 years ago. She currently works part-time as a telemarketer and has a phone and computer setup, which allows her to work at home. She reports progressive decline in functional ability in the past few years. She has had several periods of exacerbations and
remissions since the diagnosis. She lives with her husband and a teenage daughter who both help her with her daily activities. Her current complaints include weakness of the LEs, fatigue, and bouts of vision disturbances (double vision). She reports lack of sleep at night due to leg cramps. The patient also mentions falling several times, usually during the night when she gets up to go to the bathroom. The patient is able to ambulate independently at home, holding onto walls and furniture for support, as needed. In the community, she is able to ambulate short distances using a front-wheeled walker but fatigues easily. She uses a w/c as her primary mode of locomotion when outside.

ROM testing reveals tightness of bilateral hamstrings and calf muscles. Tone assessment using the modified Ashworth scale reveals a grade of 2 in the LEs. The patient demonstrates impaired UE and LE light touch and proprioception sensation, with the LEs more affected than the UEs.

Bed mobility, supine to sit, and transfers to the w/c are independent, but the patient performs these movements slowly. Sitting balance is Good for static and Fair+ to Good for dynamic. Balance in standing is Good static and Fair dynamic.

Patient scored a 16/28 in the Tinetti Balance and Gait Test and a 41/56 for the Berg Balance Test. Both of these tests indicate the patient’s increased risk for falls.

**Questions and Answers**

**Identify the following:**

(a) Impairments and functional limitations presented.

- Tightness of bilateral hamstrings and calf muscles; abnormal tone; impaired UE and LE light touch and proprioception sensation; slow performance of bed mobility, supine to sit, and transfers to the w/c; decreased sitting and standing balance, risk for falls, and unsafe gait.

(b) Potential interventions that can be performed by the PTA to assist in improving the patient’s functional performance.

- Stretching of bilateral hamstrings; interventions to decrease tone; functional mobility training; transfer training; gait training; balance training; coordination training; breathing and relaxation exercises; development of a home program including safety, strengthening, balance, and coordination activities; precautions to avoid overheating and fatigue.

**Case #3: Amyotrophic Lateral Sclerosis**

The patient is a 58-year-old male with a medical diagnosis of ALS. He reports that he was diagnosed with the condition 2 years ago. The patient is a retired truck driver and lives in a doublewide trailer with his girlfriend, who is his primary caregiver. The patient received home health supportive services: a nurse visits every month and a home health aide every other day to assist him with self-care activities.

The patient is still capable of speech communication, but his caregiver reports that the patient’s speech is getting worse. The patient also reports difficulty in breathing at night and gets supplemental oxygen. During the time of the examination, the patient’s vital signs are as follows: BP is 120/90, pulse is 88, and respiration is 20.

The patient is incontinent of bladder and has a foley catheter in place. Inspection of the skin reveals a slightly reddened sacral area. He is able to move in bed with minimal assistance and use of the overhead trapeze bar. He requires minimal assistance to get up from supine to sit and to transfer from the bed to the w/c. The patient demonstrates poor sitting and standing balance. He is able to stand with minimal assist and take a few steps with assistance, but is unable to functionally ambulate. The patient uses the w/c as his primary mode of locomotion.

The patient demonstrates bilateral plantarflexion contractures and some tightness of both hamstrings. He has spasticity of both LEs (Grade 2 on the modified Ashworth Scale). Strength of both LEs and UEs is generally 3 to 3+/5. Patient demonstrates absent proprioception for both LEs and impaired light touch sensation bilaterally.

**Questions and Answers**

**Identify the following:**

(a) Impairments and functional limitations presented.

- Difficulty in breathing at night (and gets supplemental oxygen); incontinent of bladder; skin breakdown; decreased functional mobility, transfers, and bilateral plantarflexion contractures; some tightness of both hamstrings; spasticity of both LEs; absent proprioception for
both LEs; and impaired light touch sensation bilaterally.

b. Potential interventions that can be performed by the PTA to assist in improving the patient’s functional performance.

ROM exercises to both LEs; patient/caregiver training for proper positioning, turning in bed, and skin care; interventions to decrease tone; functional mobility training; transfer training; coordination training; breathing and relaxation exercises; discussion with supervising PT for possible referral to respiratory therapist for examination of respiratory status; and referral to speech pathologist to explore alternative communication strategies.

CHAPTER 13

By Christine R. Wilson, PhD, PT

CHAPTER QUESTIONS AND ANSWERS

Regarding interactions between the cardiopulmonary and neuromuscular systems:

1. During an exercise session, how can a PTA monitor the cardiovascular and pulmonary response to exercise?

   The PTA can observe for facial expression, facial color, nasal flaring, excessive accessory muscle usage, and the appearance of shortness of breath. If the patient is wearing an oximeter or a HR monitor, the machine’s readout can be noted. The pulse and BP can be measured by the PTA. Lastly, the patient can be asked how he or she is feeling.

2. The appearance of which signs and/or symptoms indicate that the PTA should have the patient stop exercising and should report the signs and/or symptoms to the PT?

   The development of any chest discomfort, shortness of breath, dizziness, or muscle cramping indicates that exercise should be stopped, and the signs and symptoms should be reported to the PT. In addition, if an arrhythmia appears or if BP drops or rises excessively, exercise should cease and the changes reported to the PT.

3. You are working with a patient who has chronic left heart failure. What signs and symptoms might indicate that the heart failure is progressing (getting worse)?

   Dizziness, lightheadedness, shortness of breath, wheezing (caused by fluid backing up into the lungs), cough productive of white or pinkish secretions, decreased BP (hypotension), and decreased oxygen saturation (SpO₂) detected by oximetry. In addition, the patient might report that he or she is fatigued.

4. You ask a patient to give a strong cough, but the patient repeatedly produces a weak cough. What are some possible reasons why the patient cannot produce a strong cough?

   The patient may be unable to inspire a sufficient volume of air to generate a strong cough. This could be due to skeletal abnormalities (e.g., fractured ribs or kyphoscoliosis), inspiratory muscle weakness or paralysis, or central or peripheral nervous system pathology, which limits the ability of the patient to generate sufficient inspiratory muscle force. Alternatively, the patient may be generating insufficient force with the expiratory muscles. This can be caused by inadequate use of the abdominal muscles (which can sometimes be corrected by indicating the importance of pulling the stomach in during a cough), expiratory muscle weakness or paralysis, or neuromotor pathology affecting the expiratory muscles. Additionally, the patient may fear becoming incontinent during a cough, causing them to generate a weak cough to avoid this consequence. Another possibility is that the patient is not in the optimal position to generate a strong cough. Most people generate the strongest cough in the upright position (sitting or standing), but this can vary from person to person in the neurorehabilitation setting. It is best to ask the patient which position is best for him or her.

5. You are working with a patient on his exercise program, and you hear that a patient’s breathing is accompanied by a wheezing sound. What might be causing the wheezing? Will you take any action?

   Wheezing is usually caused by narrowing of the small bronchioles (airways) in the lungs. This narrowing can be caused by asthma, secretions, or pulmonary edema secondary to left heart failure. The PTA could ask the patient if he or she notes the wheezing and knows why it is occurring. Many patients with asthma carry a bronchodilating medication with them, which is delivered using an inhaler. If exercise causes wheezing, these patients are usually instructed to use the medication immediately before exercising. It is best to check with the PT about this patient’s medication usage. If the wheezing is caused by secretions, the patient may report that she or he has been coughing up secretions recently. It is possible that the secretions can be expelled with a strong cough and
that the exercise can continue if the wheezing disappears. However, the PTA should report to the PT that the patient is producing secretions. If the patient has heart failure, if the bronchodilating medication does not abolish the wheezing, or if the PTA does not know why the wheezing is occurring, then exercise should not continue, and the PT should be notified of the symptom(s) immediately.

CASE STUDIES

Case #1

Patient is a 72-year-old male with moderately severe emphysema who has recently developed PD. The patient can ambulate independently but needs assistance moving from supine to a sitting position and standing from a seated position. He also becomes short of breath during these activities. The PT has delegated to the PTA an activity designed to increase trunk rotation, which is needed in order to move from supine to sidelying. The activity begins with the patient supine, knees bent, and shoulders abducted 90 degrees. The patient is asked to inhale and, as he gently exhales through pursed lips, let his knees gradually fall to the right to rest on the bed. He inhales and, as he is exhaling through pursed lips, moves his knees past the starting position, continuing the movement until his knees rest on the bed to the left. The PTA is asked to provide hands-on assistance to the patient, if necessary.

Questions and Answers

1. Why has the PT asked the PTA to do this activity, and why has the PT asked the PTA to include the breathing instructions with this activity?

   This activity will increase the patient’s ability to rotate the trunk, which is required in order for the patient to be able to move safely from supine to sidelying. The patient states that he becomes short of breath when he tries to get out of bed in the morning. When the patient coordinates his breathing with the phases of movement, he avoids holding his breath while continuing to provide oxygen to and remove carbon dioxide from the working skeletal muscles. Exhaling through pursed lips may decrease breathlessness by slowing the respiratory rate and decreasing the air trapping that is characteristic of obstructive pulmonary disease.

2. Is the request within the domain of the PTA?

   Yes.

3. Would you take any baseline measurements before starting this activity?

   Yes. It is necessary to measure HR, BP, and respiratory rate in an individual with cardiovascular or pulmonary disease before exercise begins. This allows the PTA to assess whether any vital sign changes have occurred since the last visit. Changes in baseline measurements should be reported to the PT before exercise begins so that the PT can determine whether or not the patient should participate that day. In addition, the baseline measurements will be compared to measurements taken just after the activity has finished (and perhaps during the activity as well) in order to determine the physiological responses to the intervention. Lastly, since some individuals have difficulty lying flat, it is helpful to ask the patient if he requires more than one pillow in order to be comfortable in the supine position.

4. How would you determine the patient’s tolerance to the activity?

   Since any changes in the rate and depth of breathing can lead to hyperventilation, the PTA should ask the patient during the activity whether he is feeling at all lightheaded. If so, the patient should resume his normal breathing pattern for a few minutes. The PTA should observe for changes in facial expression, facial color (eg, flushed or very pale), excessive use of inspiratory accessory muscles (sternocleidomastoid, upper trapezius), and decreased ability to verbalize in the usual pattern. If the patient’s breathing appears fine but it becomes increasingly difficult for the patient to do the activity, a rest is probably needed.

5. When would or why would the PTA ask the PT to reevaluate in order to change the interventions delegated?

   Reevaluation is indicated if the patient is unable to do the activity or becomes very short of breath, dizzy, or lightheaded during the activity. In addition, whenever an irregular HR develops or BP decreases or increases excessively during an activity, a reevaluation is in order.
Case #2
This patient is a 66-year-old female who had a right cerebrovascular accident 4 weeks ago. Several days after the CVA, she was transferred to an extended care facility, where she developed bacterial pneumonia in the second week of her stay. She is able to resume physical therapy but still has a cough, which produces thin, clear secretions. She requires moderate assistance to stand up from a chair and to ambulate a few steps with a walker and has difficulty supporting weight on her left leg. The PT has delegated to the PTA a breathing exercise. The patient is lying on her right side with the left arm supported by a pillow. The PTA’s hand is placed on the left lower chest wall and over the ribs. During inspiration, the patient is asked to focus on moving air into the left lung and to move her ribs up into the PTA’s hand. The PTA may perform a quick stretch maneuver just before the patient begins to inspire in order to facilitate active expansion of the left lower chest during inspiration. The breathing exercise is then performed with the patient sitting and the PTA’s hands on the right and left sides of the lower chest. After a deep inspiration, the patient is asked to give a strong cough.

Questions and Answers
1. Why has the PT asked the PTA to do this activity?
   The patient continues to have secretions in the lungs, which can interfere with gas exchange. The CVA may have affected the patient’s ability to expand the left chest wall, which would limit the patient’s ability to breathe deeply and produce a strong cough. This activity is designed to increase expansion of the left chest wall and improve clearance of secretions from the lungs, thereby improving gas exchange. Performing this breathing exercise first may improve the patient’s tolerance of other activities (eg, gait training).

2. Is the request within the domain of the PTA?
   Yes.

3. Would you take any baseline measurements before starting this activity?
   A CVA is a vascular problem with neurological consequences. Many individuals who have had a CVA have either high BP or abnormal BP regulation. In addition, atherosclerosis is very common in this population of individuals, which increases the risk of a heart attack. Before starting any activity, HR, BP, and respiratory rate should be measured in all individuals with a CVA. When first working with a patient with a CVA, HR and BP should be measured after a change in position (eg, lying in bed to sitting, sitting to standing).

4. What might interfere with the patient’s ability to do the activity?
   The patient may not be able to do the activity because the sidelying position is uncomfortable. In order for the sidelying breathing exercise to be effective, it is important that the patient be relaxed and well supported. Positioning of the head, arms, and legs should be adjusted to ensure comfort before the exercise begins. As with any breathing exercise, hyperventilation-causing lightheadedness should be avoided. In the sitting position, decreased weight bearing on the left hip causes side bending to the left and limits the expansion of the left chest wall. Therefore, a symmetrical sitting posture should be attempted. Some individuals are not able to produce a cough voluntarily, in which case a huffing maneuver can be taught.

5. When would or why would the PTA ask the PT to reevaluate in order to change the interventions delegated?
   The PT should reevaluate if there are changes in HR, BP, and respiratory rate since the last visit or if the patient is unable to perform the activity.

Chapter 14
By Carol M. Davis, PT, EdD, MS, FAPTA

Case Studies

Case #1
Complementary Therapy in a Traditional Rehabilitation Setting
Mrs. J was referred to Dr. Hagen, DPT, for examination and evaluation of balance problems. Dr. Hagen was a staff PT in an outpatient neurorehabilitation center of a large teaching hospital.
Upon examination, Dr. Hagen determined that Mrs. J, who was in good health overall, had developed her unsteady gait after moving from her two-story home to an apartment where she no longer had any stairs to climb. As a result of using the elevator and only walking on flat surfaces, her balance problems began from increasing weakness in her hips and knees. Examination using the Berg Balance Scale, including the forward reach and manual muscle testing, revealed that her problem was muscle weakness. She scored 3(-) in hip extensors, knee extensors, and ankle dorsiflexors bilaterally. No inner ear problems were noted, but she was experiencing some difficulty with her vision and her hearing.

Dr. Hagen consulted with PD, a PTA who worked with her in the neurorehab setting. Together, they devised an exercise program that included systematic strengthening of her pelvis and LEs and suggested participation in a group T’ai chi class taught by PD, the PTA, on Mondays, Wednesdays, and Fridays from 10:30 AM to 12 noon.

PD had studied T’ai chi with a T’ai chi master and had gained skill to the extent that she was able to teach T’ai chi at the rehabilitation center, as a PTA under the supervision of the Director of Physical Therapy. The state in which they practiced allowed her to practice out of line of sight of the supervising PT, and her group met in a quiet common area near the main rehab gym. PD employed the assistance of several aids and family members as “spotters” for her patients during the group session.

Mrs. J recovered her strength very rapidly with exercises and T’ai chi. PD did a follow up assessment of her balance and reported that Mrs. J was functioning safely, and she felt she was ready for Dr. Hagen to do a final discharge evaluation. Mrs. J liked the T’ai chi group exercises so much that she enrolled in a wellness center group and continued with T’ai chi for several months.

Questions and Answers

1. Was an appropriate protocol used by both the PT and PTA with the delegation to the PTA of a group class that included the complementary approach referred as T’ai chi?

Delegation was very appropriate given the background of the PTA and the needs of the patient.

2. Once Mrs. J met the objectives of the traditional interventions as well as the functional balance activities of the T’ai chi, was it appropriate for the PTA to refer Mrs. J back for final examination and discharge, or could the PTA, as a T’ai chi instructor, do this independently?

Although the PTA was a T’ai chi instructor, when practicing within the professional domain of physical therapy, it is always appropriate for the PT to complete a final examination and create the discharge plan. The decision that Mrs. J continue with T’ai chi was no longer considered an aspect of physical therapy management, and the role of the PTA changed to that of an independent T’ai chi instructor. The fact that the group class encouraged Mrs. J to continue practicing her balance within a variety of physical and social environments only reinforces her motor learning and reduces her risk of falling.

Case #2

Complementary Therapy Outside of the Rehabilitation Setting

Mr. K, a 65-year-old executive at a local bank, was evaluated by PT Connie W for beginning PD symptoms. Upon examination, Mr. K showed no involvement in his handwriting and moderate rigidity in his back and shoulders. He held his left arm in slightly more flexion at the elbow, and the fingers of his left hand were straight with slight MCP flexion. His head flexed forward 6 inches; his left arm showed diminished swing with gait, and his steps were shortened to a 12-inch stride. His turn-around time to the left was slower than the right, taking several more steps to complete. No shuffling gait was noted. No detectable tremor was found, but Mr. K reported that a slight tremor of his left hand was present upon awakening some mornings. He had full animation of his face, no seborrhea; his speech was clear and easily understood, but quiet. He reported no difficulty in self-care. He was quite concerned about how this diagnosis would affect his career at the bank, which included interaction with many powerful people who trusted him with their money. He was most anxious that he not show any sign of weakness or pathology. Muscle strength was normal throughout. ROM in left shoulder flexion was slightly diminished to 150 degrees. Trunk rotation and cervical rotation were limited to two-thirds normal. With regard to balance, one-legged stance...
time was less than 10 seconds on either foot. He was able to stand from a chair 10 times in 30 seconds without using his arms to assist. He was able to pick up a pencil off the floor, but was unable to tandem stand.

Connie W, the PT, devised a therapeutic program composed of myofascial release, which she performed focusing on opening up the occipital ridge, the thoracic inlet, and pectoral areas and working to improve fasic length for trunk rotation and shoulder flexion. Exercises were designed to emphasize increasing fluidity in spine rotation and gait. In addition, she had Mr. K practicing one-legged stance and tandem stance at the sink at home and wanted him to start practicing yoga on a regular basis.

Estelle F, a PTA working with Connie W in the rehabilitation center, was also a certified Yoga instructor and had a part-time evening and weekend Yoga practice in a small storefront location quite near the rehabilitation center. Mr. K's PT knew that Estelle F, PTA, was also an excellent Yoga instructor, who specialized in assisting people with disabilities in assuming postures with supporting towels and who emphasized therapeutic breathing. She suggested to Mr. K that he enroll in her Yoga classes on Tuesday and Thursday evenings. Thus, Connie W, PT, would see Mr. K as an outpatient in the rehabilitation center on Mondays and Fridays, and Mr. K would take Yoga on Tuesday and Thursday evenings. This plan appealed to Mr. K, who sensed that he really must not be “all that disabled” if he could take Yoga as part of his physical therapy.

Estelle F, PTA, spoke with Connie W about Mr. K when he enrolled in her evening Yoga classes on Tuesday and Thursday evenings. Thus, Connie W, PT, would see Mr. K as an outpatient in the rehabilitation center on Mondays and Fridays, and Mr. K would take Yoga on Tuesday and Thursday evenings. This plan appealed to Mr. K, who sensed that he really must not be “all that disabled” if he could take Yoga as part of his physical therapy.

Estelle F, PTA, spoke with Connie W about Mr. K when he enrolled in her evening Yoga class. Connie W was able to share her examination and evaluation information on Mr. K with Estelle F and suggest an emphasis on trunk rotation and UE range in addition to yoga breathing exercises. Estelle F was able to supplement Mr. K’s rehabilitation by implementing these suggestions in Mr. K’s Yoga practice with much success.

Questions and Answers

1. Would the myofascial release techniques and the traditional exercises be considered physical therapy?

Yes, techniques used by a PT within a physical therapy environment would be considered physical therapy.

2. Would recommending yoga as a life activity be considered physical therapy, and should the PTA consider her class as part of the PT interventions designed by the PT? If so, how would the PT and PTA deal with the concept of supervision? If not, why would the PT recommend the individual enroll in the yoga class?

No, unless the PTA is supervised within a physical therapy environment, the activity would not be considered physical therapy intervention. A PT might recommend a variety of activities outside an established home program, such as recommending that an individual practice swimming or walking with his or her spouse. These are considered life activities and not a physical therapy program. Life activities encourage the individual to participate in the physical, emotional, cognitive, spiritual, and social aspects of life.

3. Once the individual completed the intervention aspect of the traditional PT program and continued with the yoga, would it still be considered physical therapy?

No, once Mr. K was discharged from physical therapy, his physical therapy management had concluded. The fact that he continued with Estelle F, PTA was because yoga as an exercise or life activity met certain aspects of Mr. K’s life. In the role of a yoga instructor, Estelle would be responsible for her students and their health and safety.

REFERENCES

