The Advancement of Rwandan Rehabilitation Services Project

Presents

THE EVALUATION AND TREATMENT OF NEUROLOGICAL CONDITIONS

September – December 2014

Taught by

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Presented in Partnership with

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Advancement of Rwandan Rehabilitation Services Project

Neurology Course
Unit One

Lesson Plans: Day 1

OBJECTIVES

1. Describe your experience using frameworks to improve daily life.
2. Describe a sample of practice frameworks used to classify patients and improve clinical decision-making.
3. Identify frameworks for movement analysis and function.
4. Apply neuromuscular facilitation techniques to developmental motor skills in order to improve motor function.
5. Evaluate patient data to formulate a plan of care with strategies to improve motor function.

EXPERIENCE WITH FRAMEWORKS

As a group, we will attempt to build a puzzle using inter-locking pieces. We will discuss your thoughts on this experience, as well as others, as a large group.

IDENTIFYING CLINICAL PRACTICE FRAMEWORKS

Watch and listen to the slide show presentations on *Practice Frameworks for Clinical Decision Making* and *Frameworks for Movement Analysis and Function*. Follow along on the outlines provided. We will discuss your questions as a large group.

APPLYING FACILITATION TECHNIQUES TO DEVEOPMENTAL SKILLS

With a partner, practice applying neuromuscular facilitation techniques to developmental motor skills. We will review some skills as a large group.

FORMULATING A PLAN OF CARE USING STRATEGIES TO IMPROVE MOTOR FUNCTION

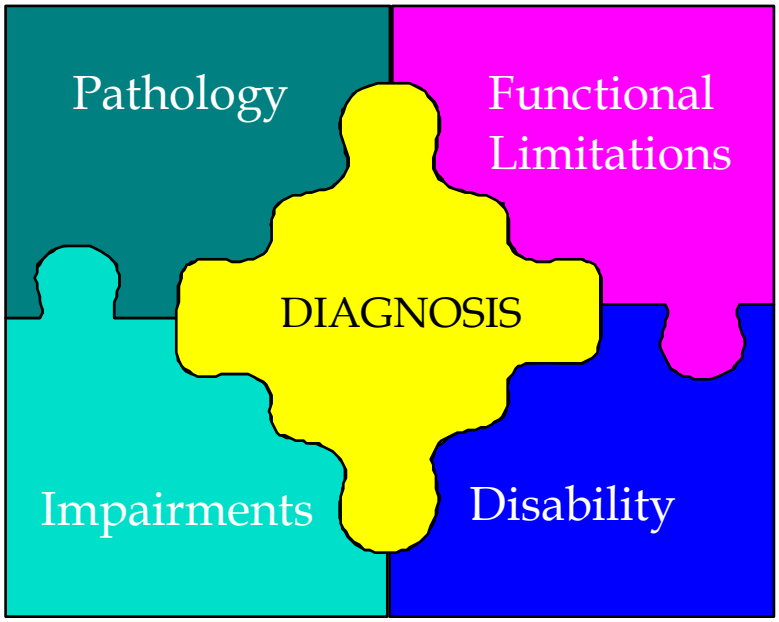
Individually, read the case study provided. In small groups (4-5 people), answer the guiding question. We will discuss and demonstrate a sample of answers as a class at large.

Practice Frameworks for Clinical Decision-Making

OBJECTIVE: Describe a sample of practice frameworks used to classify patients and improve clinical decision-making.

What did you do to get here this morning?

CLASSIFYING PATIENTS: THE PROBLEM WITH PATHOLOGY



This puzzle is one way to think about patients to help us plan our care. It can help us describe patients' problems more completely. We need to recognize that a particular patient is like a group of patients but is also an individual. In other words, no two patients that suffer a stroke will be exactly alike but they should have some similarities. This model can be used as the basis for physiotherapy decision-making. It shows four different types of classifications that we can use to describe patients.

The most common way that we classify patients is the pathology that causes the patient's problems. It is this classification of pathology that is the thing we usually think of when we think of diagnosis, what we typically call 'disease,' but it is only *one* way to classify patients. In this model, the pathology is seen as the first piece of the puzzle, and only one part of the complete picture that explains the health status of the patient. Every pathology has the potential to cause problems in the human body.

Problems that are at the organ or system level are called impairments. For example the pathology of fracture results in an impairment of pain. Much of physiotherapy care is spent in trying to reduce impairments, therefore it seems logical that classifications by impairment can help guide our care.

The next piece of the puzzle is the functional limitation. Impairments can result in the inability to carry out functional activities. For example, pain can result in altered gait, with decreased endurance. This is also an area that gets a great deal of attention from physiotherapists. Again, wouldn't it be helpful to you to classify patients by functional limitations?

Disability is the last piece of the puzzle. Disability moves beyond the biological events and begins to look at the person. A disability occurs when the person's functional limitations interfere with the person's role in life, be it work, family, or leisure roles. For example, loss of power and flexibility (impairments) result in a functional limitation in kicking, but this only becomes a disability if kicking is part of the person's work or leisure activities, such as a footballer. Physiotherapists are taking an increasing role in defining and reducing disability, therefore classifying patients by disability is also important.

As we all know, the events that occur after pathology are not identical in every patient with the same pathology. There are many factors that can affect the development of impairments and functional limitations.

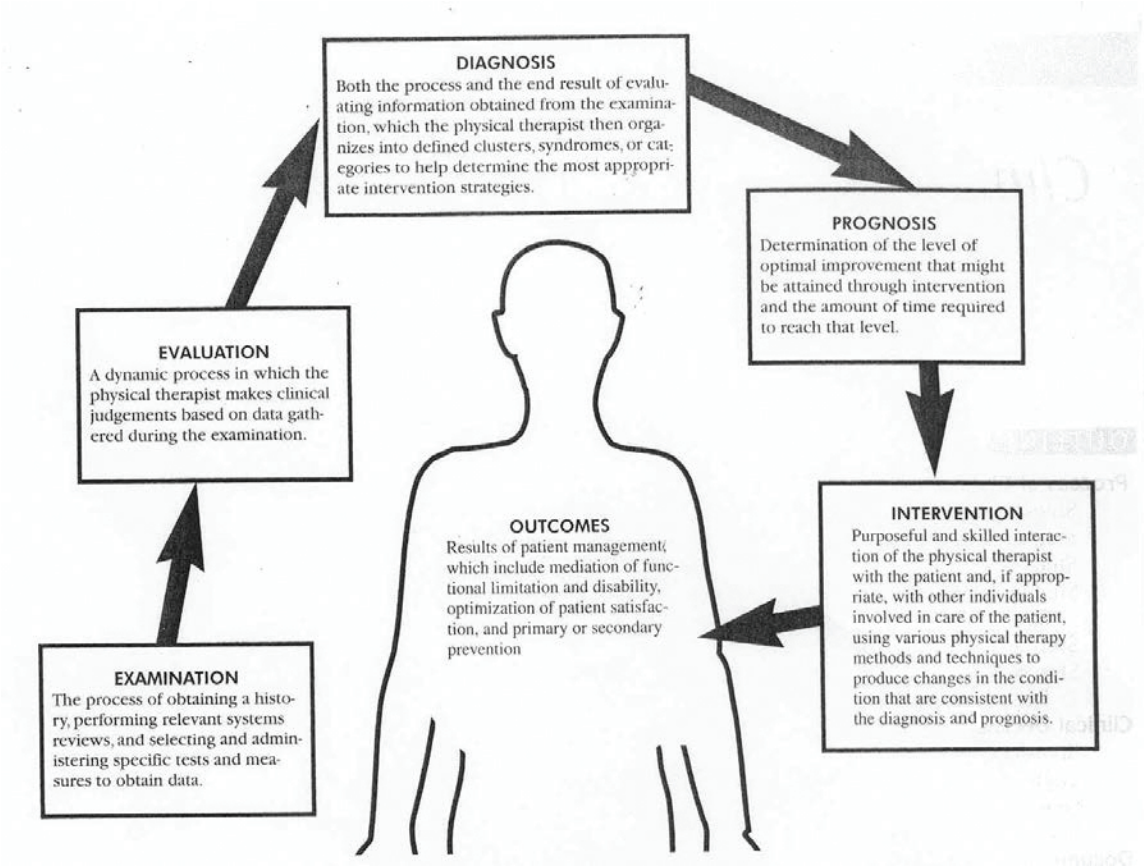
We have typically thought of the left hand part of the model as the realm of the medical world and the right hand as the realm of the social care, but all of it fits together to fully describe the total health of the patients. Traditionally, we have placed ourselves as physiotherapists in the area of impairments and functional limitations. Our tests and measures and our treatments are primarily designed to help us identify these types of problems in patients and to reduce them as much as possible. But, we can also be more active in identifying outcomes related to pathology and disability.

THE ICF

The World Health Organization developed the International Classification of Functioning, Disability, and Health (ICF) as a framework or classification system for describing the facets of human functioning that may be affected by a health condition. The aim of the ICF is to provide a ***scientific basis*** for the consequences of health conditions, establish a ***common language*** to improve communications, permit ***comparisons*** of data across countries, health care disciplines, services, and time, and provide a ***systematic coding scheme*** for health information systems. Their model looks like this:

Impairments Functional Limitations Disability

PATIENT CARE MANAGEMENT MODEL



The Patient Care Management Model is another framework we can use to help our clinical decisions. We generally start the examination process with the history. By learning about the patient's past and current status, as reported by the patient and others, we begin to focus on the specific tests we'll perform but we also continue to learn more from the patient each time we encounter him/her. Just as physicians perform a quick check of the systems each time they see a patient, so should physiotherapists. A review of the system consists of simple measures that help us decide if further specific testing is needed. We then choose specific tests and measures based on the results of the history and systems review. We use all of this data to help us arrive at conclusions about the patient.

In the patient care management model, evaluation is not the physical act of collecting data, but rather the judgment in which the physiotherapist uses the data from the examination to make clinical decisions about the patient.

One of the decisions that we make through evaluating the examination data is the patient diagnosis. Remember, since a patient is more than just their pathology, we need to make a diagnosis that recognizes their impairments, functional limitation, and disabilities.

Prognosis is another of the decisions we make based on the examination. We are more used to the concept of prognosis, as we have been predicting how long it will take us to reach certain goals in our plans of care for years. But, again, do we use/have tests that help us identify which patients will recover or how far they will recover?

The final decision we make based on the examination is the choice of interventions or treatment options. These make no sense if we have not classified the patient appropriately.

Finally, the model says that we must make all of our decisions with clearly defined expectations for outcomes. This also means that we need ways to measure outcomes in individual patients and in groups of patients. Very often, especially when measuring impairments and functional limitations, the same tests we use in diagnosis can be used in outcome measurement. For example, Manual Muscle Testing can be used to measure strength gain following treatment. Other outcome tools exist to help us measure changes with a patient's function. The **Patient Specific Functional Scale** is one such outcome tool.

PATIENT SPECIFIC FUNCTIONAL SCALE

The importance of physiotherapy is that our services can increase a patient's function. We can help a patient to perform an activity that was impossible to perform effectively prior to our treatment. We have a large number of functional tests available to determine how effective our treatments have been in accomplishing the goal of increased function. Unfortunately, completing many of these tests can take valuable time away from treating your patient as you try to figure out which test to use and how to score it. The Patient Specific Functional Scale gives us the benefit of using a validated functional test with a minimum of time and effort. Here is how the test works:

1. During the subjective exam, ask your patient to identify three activities she/he is having difficulty with as a result of the injury or diagnosis for which they are receiving therapy.

2. For each of these three items, have the patient rate how difficult the activity is, on a scale from zero (0) to ten (ten). Zero means no difficulty and ten means the activity is impossible for the patient to perform.

3. Add the score on the three activities and translate it into a percentage score: patient total score x 100 and then divided by 30. This is the percentage score you record and monitor for progress during the course of therapy.

The Patient Specific Functional Scale can help you establish your patient's goals because he/she has identified for you the 3 most important functional activities for them. It can also serve as a measure of progress from the first day of therapy until discharge. It is fast, simple, relevant, valid and can be used for any diagnosis. It will serve you well for nearly all of your patients.

Please list three activities that are difficult for you because of the condition we are treating.

Activity 1: _____

0---------1---------2---------3---------4--------5---------6---------7----------8----------9--------10

No Difficulty Moderate Difficulty Impossible

Activity 2: _____

0---------1---------2---------3---------4--------5---------6----------7----------8---------9--------10

No Difficulty Moderate Difficulty Impossible

Activity 3: _____

0---------1---------2---------3---------4--------5---------6----------7----------8----------9-------10

No Difficulty Moderate Difficulty Impossible

Total Score: Activity 1+ Activity 2 + Activity 3 = _____

To calculate PERCENT DISABILITY: Multiply the score by 100, and then Divide by 30

CLASSIFYING FUNCTIONAL LEVELS – FIM

Functional activity is a patient-referenced concept and is dependent on what the individual self-identifies as necessary. When describing our level of assistance with patients, therapists should use terms that are well defined. Meanings of descriptive terms should be clear to all others using the medical record. Listed below is a sample set of acceptable terms and definitions.

Independence: person is able to perform skill safely with no one present, in a reasonable amount of time, and does so without modification or adaptation.

Modified Independence: person is able to perform skill safely with no one present but requires an assistive device or aid, a modification of the environment, or the activity takes more than a reasonable amount of time or involves safety (risk) considerations.

Supervision: person requires no physical contact to perform skill but needs standby guarding, cuing, or encouragement for safety; alternately, the helper sets up needed items or applies orthoses or assistive/adaptive devices prior to the person completing the skill.

Minimal Assistance: person is able to complete a majority of the activity without assistance; requires no more help than touching and expends 75% or more of the effort.

Moderate Assistance: person is able to complete part of the activity without assistance; requires more help than touching and expends between 50-74% of the effort.

Maximal Assistance: person is unable to assist in much of the activity; expends between 25-49% of the effort.

Total Assistance: person is unable to assist in any part of the activity; expends less than 25% of the effort.

SUMMARY

- Frameworks like the International Classification of Functioning, Disability, and Health (ICF) and Patient Care Management Model can help guide our clinical decision making process.
- The Patient Specific Functional Scale is a useful tool to measure outcomes.
- Functional terminology can help describe a patient's performance level

Frameworks for Movement Analysis and Function

OBJECTIVE
Identify frameworks for movement analysis and function

MOTOR SKILL CLASSIFICATION

Mobility
Stability
Controlled Mobility
Skill

Mobility is the ability to move a body part from one position to another. Stability is the ability to maintain postural control and position with the body not in motion (standing or sitting). Controlled mobility is the ability to maintain postural control and position while parts of the body are in motion (lifting one foot off the ground or reaching forward). Skill is the ability to perform coordinated movement (walking, rolling over, opening a door). It combines mobility, stability, and controlled mobility and allows us to complete functional activities.

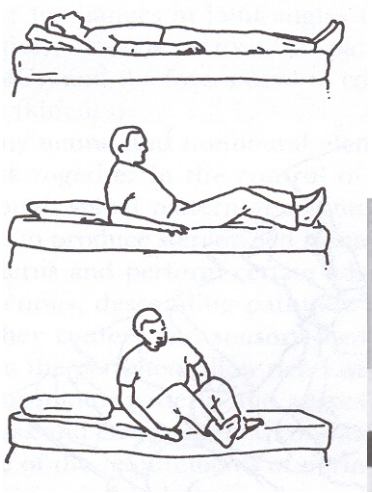
TRANSFER TASKS: sit to stand, supine to stand (floor transfer), rising from a bed (supine to sit), rolling, and moving from one chair to another

Although mobility is often thought of only in relation to gait or walking, many other aspects of movement are important to independence in daily life activities. The ability to change positions is a fundamental part of mobility.

Supine to Sit (rising from bed)
When getting out of bed, movement patterns are extremely variable. Researchers examining movement patterns used by young adults to rise from a bed found 89 patterns among 60 subjects (interestingly, no subject used the same strategy consistently in 10 trials of getting out of bed).

One of the most common patterns, a roll-off pattern, includes: pushing with the arms or grasping the side of the bed and then pulling with the arms, flexing the head/trunk and lifting the legs into a partial sit position, and rolling up into stance. This pattern emphasizes mobility. Another pattern, sometimes called a come-to-sit pattern, requires moving in stages from supine to side-lying first, then pushing up to a sitting position and from there standing up. This pattern emphasizes stability.

There are some trade-offs between mobility and stability requirements in the different patterns. For example in the roll-off pattern, motion is achieved with greater efficiency at the expense of stability. Alternatively, the come-to-sit pattern may require more force to keep the body in motion, but stability may be greater. Evidence suggests the importance of helping patients with neurological impairments to learn a variety of ways to get out of bed.

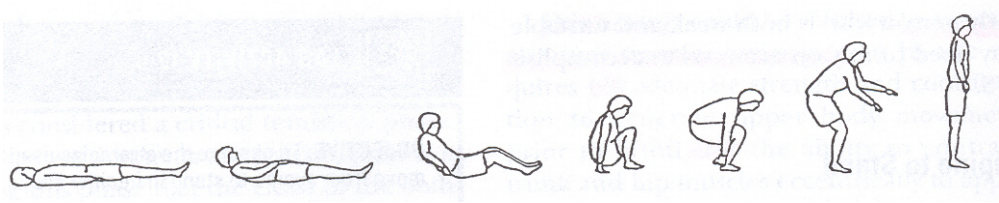


Roll-off pattern Come-to-sit pattern

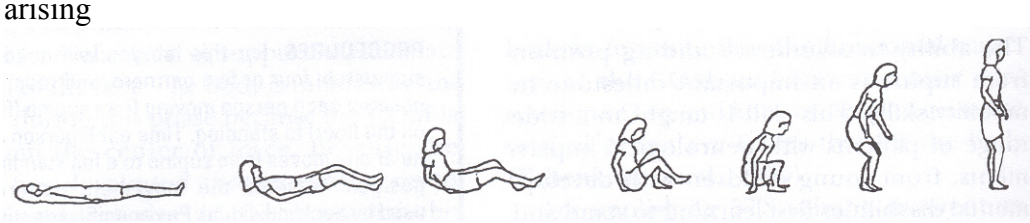
Supine to Stand (floor transfer)

For analysis of this movement, the body is divided into three components: upper extremity, lower extremity, and axial region (trunk/head). Choice of strategy is influenced by lifestyle factors including level of physical activity as well as age or maturation level of the nervous system.

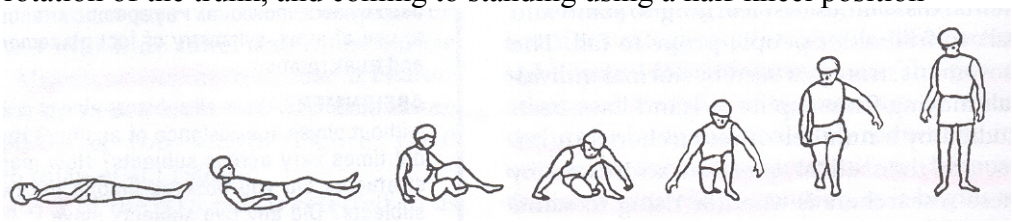
<u>Symmetrical Trunk and Symmetrical Squat</u> – characterized by symmetrical movement of the trunk and extremities and symmetrical squat to achieve vertical position



<u>Symmetrical Trunk and Asymmetrical Squat</u> – characterized by asymmetrial squat on arising

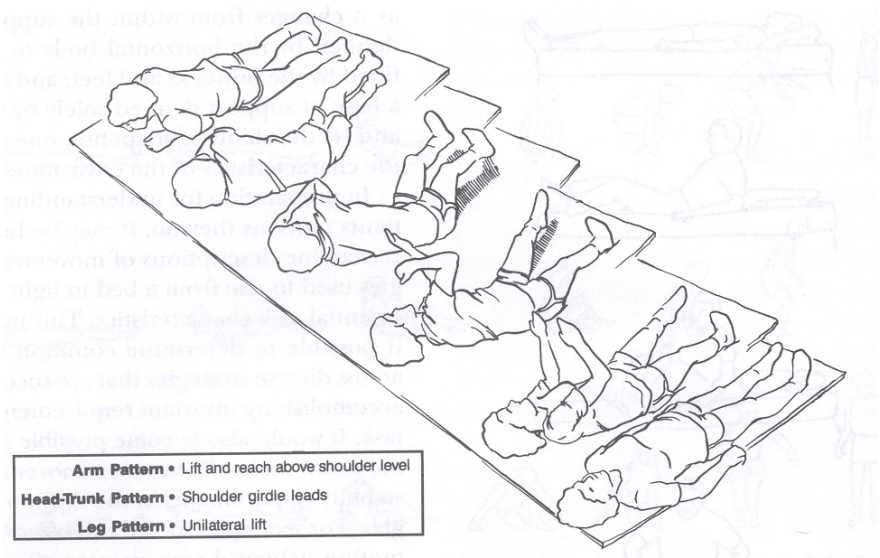


Asymmetrical Trunk Movements – characterized by asymmetrical use of UE, a partial rotation of the trunk, and coming to standing using a half-kneel position

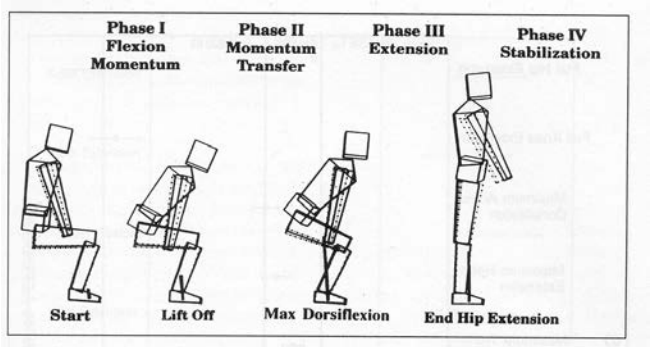


Rolling

Movement strategies used to roll from supine to prone or back to stomach are also variable. The pattern illustrated below is one of the most common; however, there is no one correct way to accomplish this movement so therapists may exercise freedom in retraining movement strategies for patients with neurological impairments. Essential features of this pattern include a lift-and-reach arm pattern, with the shoulder girdle initiating motion of the head and trunk, and a unilateral lift of the leg.



Sit to Stand



Four-Phase Model (Schenkman et al)

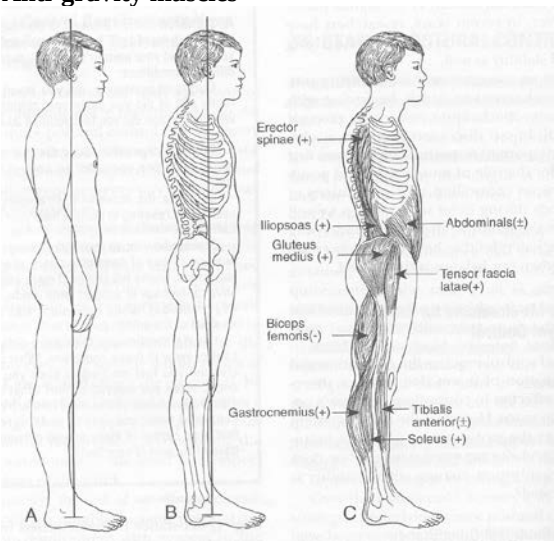
Phase I – Flexion Momentum or Weight Shift
Motion: begins with initiation of the movement and ends just before the buttocks lift off from the seat of the chair
Muscle activity: erector spinae (eccentric control of forward trunk motion)

Phase II – Momentum Transfer
Motion: begins as the buttocks lift off from the seat of the chair and ends when maximum ankle dorsiflexion is achieved
Muscle activity: coactivation of hip and knee extensors

Phase III – Extension or Lift
Motion: begins just after maximal ankle dorsiflexion and is completed when the hip first ceases to extend
Muscle activity: extensors of hip and knee

Phase IV – Stabilization
Motion: begins just after the hip extension momentum ceases and continues until all motion associated with stabilization from rising is completed (not easily defined)
Muscle activity: anti-gravity muscles (see picture below)

Anti-gravity muscles



DEVELOPMENTAL MOTOR SKILLS

The development of functional skills is a continuously evolving process throughout the lifespan. Foundational skills learned in infancy and childhood, often referred to as developmental motor skills, remain important skills throughout life. Examples of these postures/activities are listed below and continue to be a focus of re-training function in the neurological patient. They can also be grouped into the four categories of motor skill classification (mobility, stability, controlled mobility, skill).

- Prone
- Prone on elbows
- Creeping/crawling
- Bridging
- Sitting
- Kneeling/half kneeling
- Supported standing
- Standing

SUMMARY

•Many frameworks or classification systems exist to help analyze movement
•Great variability exists in the types of movement patterns a person selects
•Foundational skills learned in infancy and childhood remain important functional skills throughout the lifespan

Developmental Motor Skills Lab

OBJECTIVE: Apply neuromuscular facilitation techniques to developmental motor skills in order to improve motor function.

Neuromuscular facilitation techniques are a group of techniques used to facilitate or inhibit muscle contraction or response. They originate from traditional approaches such as PNF and NDT (Bobath).

FACILITATION TECHNIQUES FOR RESTORING STABILITY

Alternating Isometrics
Isometric contraction of the agonist pattern in one direction followed by an isometric contraction of the antagonist pattern in the opposite direction. Resistance may be applied in any direction: medial/lateral, anterior/posterior, or diagonal.

Rhythmic Stabilization
Isometric contraction of the agonist pattern in one direction as well as the antagonist pattern in the opposite direction; this results in co-contraction of opposing muscle groups. Resistance is generally applied in a rotational direction.

Agonist Reversal
Resistance applied to concentric movement followed by resistance applied to eccentric movement of the same muscle. Typically used in bridging, sit-to-stand, and stepping up/down.

FACILITATION TECHNIQUES FOR RESTORING MOBILITY

Rhythmic Initiation
Begins with passive movements, followed by active-assisted movements, then progressed to resisted movements (using light tracking resistance to isotonic contractions). May be unidirectional or performed in both directions.

Slow Reversals
Begins with a slow, concentric contraction in the agonist pattern using careful grading of resistance and optimal facilitation. Then the patterns are reversed with emphasis on slow controlled movement through increments of range. An isometric hold may be added at the end of the range or at any point of weakness. The hold can be unilateral or performed in both directions.

Resisted Progression
A quick stretch and tracking resistance applied to facilitate any movement such as walking, creeping, kneel-walking, or transitional movements.

Sidelying

- Techniques: stability

  Alternating isometrics

  Rhythmic stabilization

  Agonist reversal

- Techniques: mobility

  Rhythmic initiation – rolling

  Slow reversals (hold)

- Manual contacts:

  Upper trunk, pelvis

Prone on Elbows

- Techniques: stability

  Alternating isometrics – medial/lateral, anterior/posterior

  Rhythmic stabilization

- Techniques: mobility

  Slow reversals (hold)

- Manual contacts:

  Upper trunk

Quadruped

- Techniques: stability

  Alternating isometrics – medial/lateral, anterior/posterior, diagonal

  Rhythmic stabilization

  Agonist reversal

- Techniques: mobility

  Rhythmic initiation – heel/side sitting

  Slow reversals (hold) – medial/lateral, anterior/posterior, diagonal

  Resisted progression – crawling

- Manual contacts:

  Upper trunk, upper trunk/pelvis, pelvis

Crooklying/Lower Trunk Rotation

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- Techniques: stability

  Alternating isometrics

- Techniques: mobility

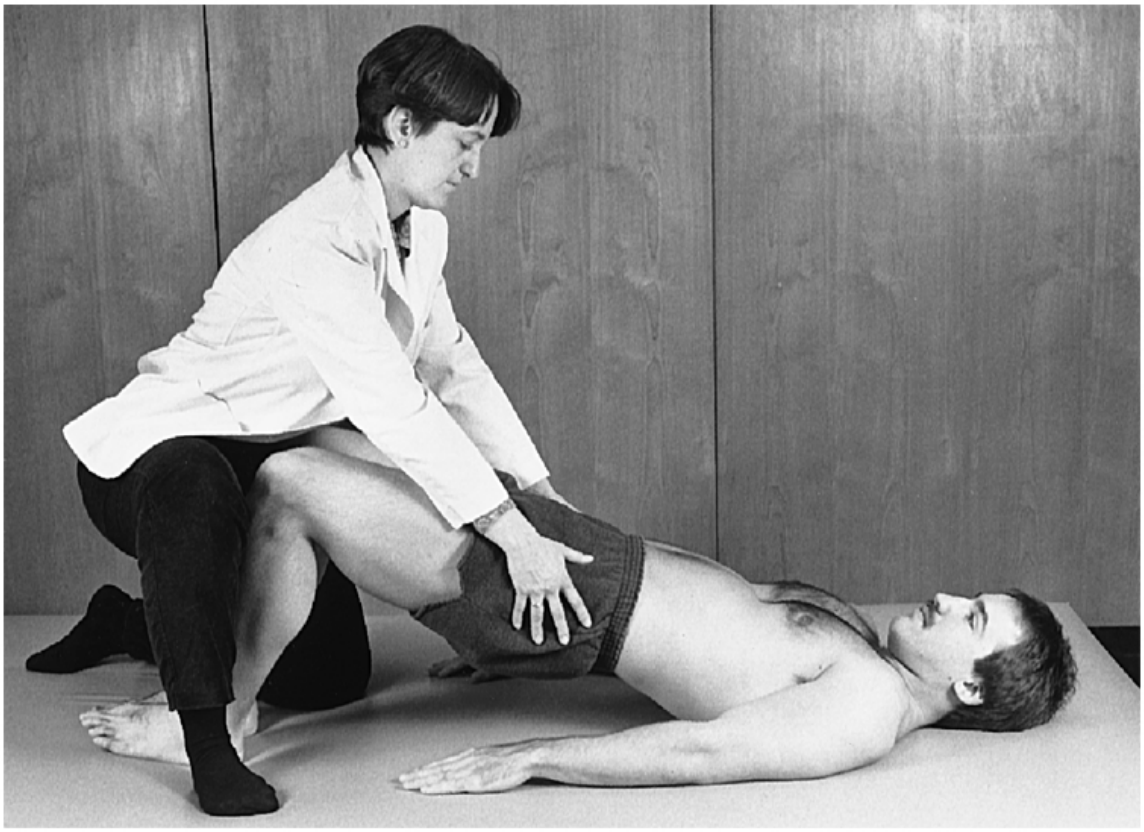
  Rhythmic initiation

  Slow reversals (hold)

- Manual contacts:

  Knees

Bridging



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- Techniques: stability

  Alternating isometrics

  Rhythmic Stabilization

  Agonist reversals

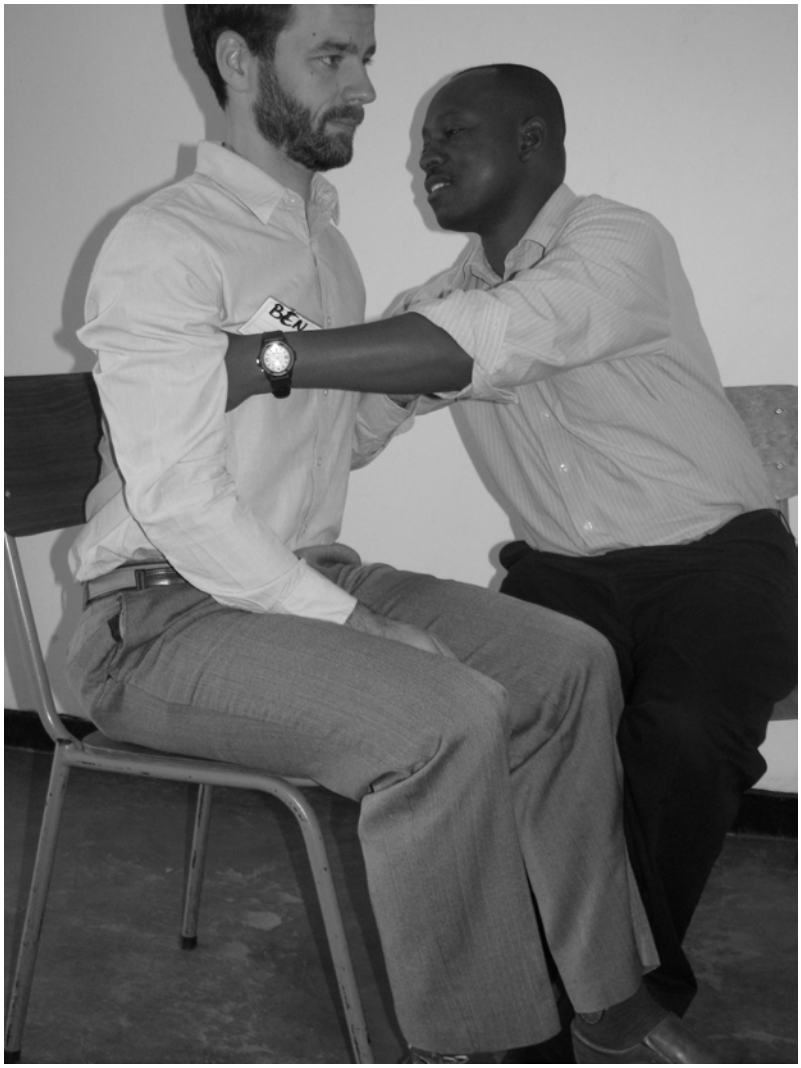
- Techniques: mobility

  Slow reversals (hold)

- Manual contacts:

  Pelvis

Sitting



- Techniques: stability

  Alternating isometrics – medial/lateral, anterior/posterior

  Rhythmic stabilization

- Techniques: mobility

  Rhythmic initiation

  Slow reversals (hold) – medial/lateral

- Manual contacts:

  Upper trunk

Kneeling

- Techniques: stability

  Alternating isometrics – medial/lateral, anterior/posterior

  Rhythmic stabilization

  Agonist reversal

- Techniques: mobility

  Slow reversals (hold) – medial/lateral, diagonal

  Resisted progression – kneel walking

- Manual contacts:

  Pelvis, upper trunk/pelvis

Half-kneeling

- Techniques: stability

  Alternating isometrics

  Rhythmic stabilization

- Techniques: mobility

  Slow reversals (hold) – diagonal

  Resisted progression – half kneeling to standing

- Manual contacts:

  Pelvis, upper trunk/pelvis

Supported Standing

- Techniques: stability

  Alternating isometrics

  Rhythmic stabilization

- Techniques: mobility

  Slow reversals (hold) – diagonal

- Manual contacts:

  Pelvis, upper trunk/pelvis

Standing

- Techniques: stability

  Alternating isometrics

- Techniques: mobility

  Slow reversals (hold) – diagonal

  Resisted progression – walking

- Manual contacts:

  Pelvis, upper trunk, upper trunk/pelvis

Strategies to Improve Motor Function
Neurological Case Study

OBJECTIVE
Evaluate patient data to formulate a treatment plan with strategies to improve motor function.

CASE STUDY
The patient is a 36-year old man who sustained a traumatic brain injury following a motorcycle accident. He is able to follow commands and auditory comprehension is good. His sitting balance is poor and requires handhold support with moderate assistance to maintain stability. He is unable to accept an outside challenge to his balance or move without loss of balance. Standing balance is also poor with maximal assistance required to maintain stance in parallel bars. He is unable to accept an outside challenge or move in standing without loss of balance. The patient can roll right and left with supervision but requires minimal assistance to transition supine to/from sit. Moderate assistance is required for transfers using a standing pivot technique. Patient is unable to walk at this time.

GUIDING QUESTION
Using the concepts of motor skill classification (mobility, stability, controlled mobility, skill) and developmental motor skills, identify some treatment options to improve this patient's motor function.

Lesson Plans: Day 2

OBJECTIVES

1. Identify problems commonly assessed by physiotherapists and recognize those that present as neurological impairments.
2. Describe the assessment procedures and treatment options available for common neuromuscular impairments.
3. Examine a clinical test of balance using functional skills as a framework for identifying the underlying impairments of postural control.
4. Establish the link between neuromuscular impairments and functional limitations.

IDENTIFYING/RECOGNIZING IMPAIRMENTS

Individually, write down three things physiotherapists assess/treat that would be considered impairments. As a large group, we will review your ideas and classify items that are associated with neurological disorders.

DESCRIBING NEUROLOGICAL IMPAIRMENTS

Watch and listen to the slide show presentation on *Assessment and Treatment of Neurological Impairments*. Follow along on the outline provided. We will discuss your questions as a large group.

EXAMINING BALANCE USING FUNCTIONAL SKILLS TO IDENTIFY UNDERLYING IMPAIRMENTS

Individually, complete the lab activity entitled *Examining a Clinical Test of Balance*. In small groups (4-5 people), compare and contrast your findings. We will discuss a sample of answers as a class at large.

LINKING IMPAIRMENTS TO FUNCTIONAL LIMITATIONS

In small groups (4-5), hypothesize what impact the impairments of a neurological patient may have on two functional tasks. Complete the grid provided. As a large group, share your findings.

Assessment and Treatment of Neuromuscular Impairments

OBJECTIVE: describe the assessment procedures and treatment options available for common neuromuscular impairments.

A comprehensive physiotherapy neurological assessment should include three (3) components: patient history, systems review, and tests/measures. Specific tests and measures for examining the neurological patient are: **mental status** (level of consciousness, orientation, attention, memory, executive/higher cognitive function); **sensory integrity** (pain, temperature, touch, pressure, kinesthetic awareness, proprioceptive awareness, vibration perception, stereognosis perception, tactile localization, two-point discrimination, double simultaneous stimulation, graphesthesia, recognition of texture, barognosis); **joint integrity/posture** (range of motion, flexibility, postural alignment); **tone** (abnormal tone); **reflex integrity** (deep tendon reflexes, superficial cutaneous reflexes, primitive/tonic reflexes); **cranial nerve integrity** (I-XII); **muscle performance** (strength, power, endurance); **voluntary movement patterns** (abnormal synergies); **functional task analysis** (functional mobility skills such as walking, standing, sitting, transferring, rolling); **postural control/balance** (postural alignment/weight distribution, sensory organization, central nervous system integration, motor strategies, functional balance tests); and **motor learning** (performance changes, practice observation, retention tests, transfer tests, learning styles).

For purposes of advancing your clinical practice skills, increasing active treatment techniques, and focusing on a return to function, we will be narrowing our discussion to the assessment and treatment of neuromuscular weakness, abnormal muscle tone, impaired balance, problems with coordination, and abnormal gait common to neurological pathologies such as stroke and traumatic brain injury. These principles can also be applied to patients with other neurological pathologies such as spinal cord injury, brain tumors, Parkinson's disease, multiple sclerosis, Alzheimer's disease, TB spine, GBS, peripheral neuropathies (HIV, DM)**.**

NEUROMUSCULAR WEAKNESS: PARESIS/PARALYSIS

Strength is defined as the ability to generate sufficient tension in a muscle for the purposes of posture and movement. Weakness is defined as an inability to generate normal levels of force. It can vary in severity from total or severe loss of muscle activity (paralysis/plegia) to mild or partial loss of muscle activity (paresis). Paralysis/paresis result from a lesion within descending motor pathways, which interferes with the central excitatory drive to the motor units. This results in an inability to recruit and/or modulate the motor neurons leading to a loss of movement.

Examination of Weakness

Manual Muscle Testing is the most common clinical approach to testing strength. A limitation of MMT is that it does not examine the ability of a muscle to participate in a functional movement pattern. Another limitation is that it cannot always be performed if the patient is unable to follow the testing commands. Sometimes, an assessment of strength is made through observation of

function. Modified positions and substitution patterns should be documented in your notes.

EXAMPLE *Supine Hip Extensor MMT: a different position*

Grade 5	Pelvis and back elevate as a locked unit while the leg is raised by the examiner. Hip maintains full extension throughout the test
Grade 4	A limited arc of hip flexion occurs before the pelvis and back elevate as a unit while the leg is raised by the examiner
Grade 3	Full flexion of the hip to the end of straight-leg raising range with little or no elevation of the pelvis. Examiner feels good resistance as the limb is raised.
Grade 2	Full flexion of the hip to the end of straight-leg raising range with little or no elevation of the pelvis. Examiner feels only minimal resistance as the limb is raised.
Grade 0	Full flexion of the hip to the end of straight-leg raising range with no active resistance felt by examiner as limb is raised. Examiner perceives that resistance is due to leg weight only.

Treatment of Weakness

- Research has found that exercise/training significantly improves strength in the affected muscles without increasing the severity of spasticity.
- **Progressive Resistive Exercises** (PRE): best strength gain at 70-80% 1 Rep Max Test x 8-10 repetitions for 1 set.

ABNORMAL MUSCLE TONE

Muscle tone refers to the level of tension in the muscle and is viewed on a continuum. Abnormal tone is defined as the resistance of muscle to passive elongation or stretch.

Flaccidity: absence of muscle tone

Hypotonia: decrease in muscle tone compared to normal

Spasticity: velocity-dependent increase in tonic stretch reflexes with exaggerated tendon jerks. In response to stretch, there is both an early activation of the muscle and a prolonged activation of the muscle that lasts as long as the displacement is applied. Though there is greater understanding of the neural mechanisms underlying spasticity, there is still no agreement on its role in functional limitations.

Rigidity: heightened resistance to passive movement of the limb but independent of the velocity of stretch. The pathophysiology of rigidity is poorly understood but is thought to be due to the disinhibition of cerebral structures normally inhibited by the basal ganglia. Rigidity tends to predominant in flexor muscles of the trunk and limbs. Commonly associated with Parkinson's disease.

Characteristics of Tone

■Tonal changes affect movement control and function

■If left untreated, abnormal tone can lead to secondary impairments such as contracture, postural asymmetries, and deformity

■Following neurological insult, tone may vary relative to recovery stage, (Example, a patient with SCI may present flaccid during spinal shock then develop spasticity over time)

■Patients may present with tonal variations between: limbs, limbs and trunk, two sides of the body, within a limb between muscles (i.e., proximal muscles vs. distal muscles), time of day, from day to day

Examination of Abnormal Tone

Subjective measurement

- Rating scales (**Modified Ashworth Scale**)
- Observation (description of abnormal posturing such as resting limb position or characteristic movement patterns such as synergy patterns)

Objective measurement

- **Pendulum or Drop Test**
  Tests for spasticity in the lower extremities. The leg is passively extended, then released, so the leg swings by gravity alone. A reduction in the number of oscillations indicates spasticity.

Treatment of Abnormal Tone

Therapeutic exercise or weight bearing activity is the primary approach used to treat abnormal tone. Examples can be found in the **Developmental Motor Skills** lab. Sensory modalities can also be used to treat abnormal tone. Examples of facilitory and inhibitory techniques are listed below.

Facilitory techniques for hypotonia

- Ice: quick strokes (stimulation)
- Vibration: high frequency
- **Quick stretch**
- **Brisk touch/tapping**
- **Joint approximation**
- **Joint traction**

Inhibitory techniques for hypertonia

- Neutral body temperature
- Vibration: low frequency
- **Prolonged stretch** (manually, casts, splints, orthoses)
- **Slow repetitive touching**

Positioning can also have an affect on abnormal tone. Supine placement can facilitate extensor tone while prone placement can facilitate flexor tone. This is because of the presence of released tonic labyrinthine reflexes in patients with lesions to the motor cortex neurons. Side-lying can inhibit ATNR and facilitate bilaterally symmetrical activities. Electrotherapeutic modalities (Neuromuscular Electrical Stimulation/Functional Electrical Stimulation) have also been shown to be effective for temporary inhibition of hypertonus when applied to agonist or antagonist muscles.

COORDINATION PROBLEMS

■The essence of coordination is the sequencing, timing, and grading of multiple muscle groups. Incoordination, (movements that are awkward, uneven or inaccurate) can result from pathology (lesions) in the motor cortex, basal ganglia, and cerebellum as well as peripheral factors such as proprioception and biomechanics. Coordination problems can cause abnormalities in functional movement.

Examination of Coordination

No universal guidelines for evaluating coordination exist. Coordination is assessed mainly by observation of functional skills. Performance can be graded subjectively by description.

■Bilateral Coordination

- ◆Tapping feet alternately while making circles with fingers
- ◆Tapping – foot and finger on same side synchronized
- ◆Tapping – foot and finger on opposite side synchronized
- ◆Jumping in place – leg and arm on same side synchronized
- ◆Jumping in place – leg and arm on opposite side synchronized
- ◆Jumping up and clapping hands
- ◆Two-foot hopping; one-foot hopping
- ◆Jumping jacks; jumping rope
- ◆Crossover walking (right and left)
- ◆Balance beam or line walking (forward, backward sideways)
- ◆Skipping/Running
- ◆Dancing

- Upper-Limb Coordination
  - Bouncing a ball and catching it with both hands
  - Bouncing a ball and catching it with preferred hand
  - Catching a tossed ball with both hands
  - Catching a tossed ball with preferred hand
  - Throwing a ball at a target with preferred hand
  - Touching nose with index fingers – eyes closed
  - Touching thumb to fingertips – eyes closed
  - Alternate forearm pronation
    supination (same direction,
    opposite direction)

Treatment of Coordination

General Techniques

- Practice and repetition of task-specific movements, rapid alternating movements, reciprocal movements, or whole-body/combined movements
- Weight-bearing activities can also help re-train coordination

Timing Problems

- Practice under time constraints
  - Music
  - Metronome
- Timing patients
  - Stop watch
- Feedback
  - Visual
  - Verbal
  - Manual
- Sensory stimulation
  - Facilitation techniques

****Few, if any, of these techniques have been subjected to experimental testing****

Grading Problems

- Practice a wide variety of tasks that require precise grading of force
- Provide feedback
- Perform tasks
  - <u>Slowly</u> to increase the demand for force control
  - Require a high degree of <u>accuracy</u>
  - Examples: large target vs small target, full cup vs empty cup

IMPAIRED BALANCE

Examination of Balance – Three levels

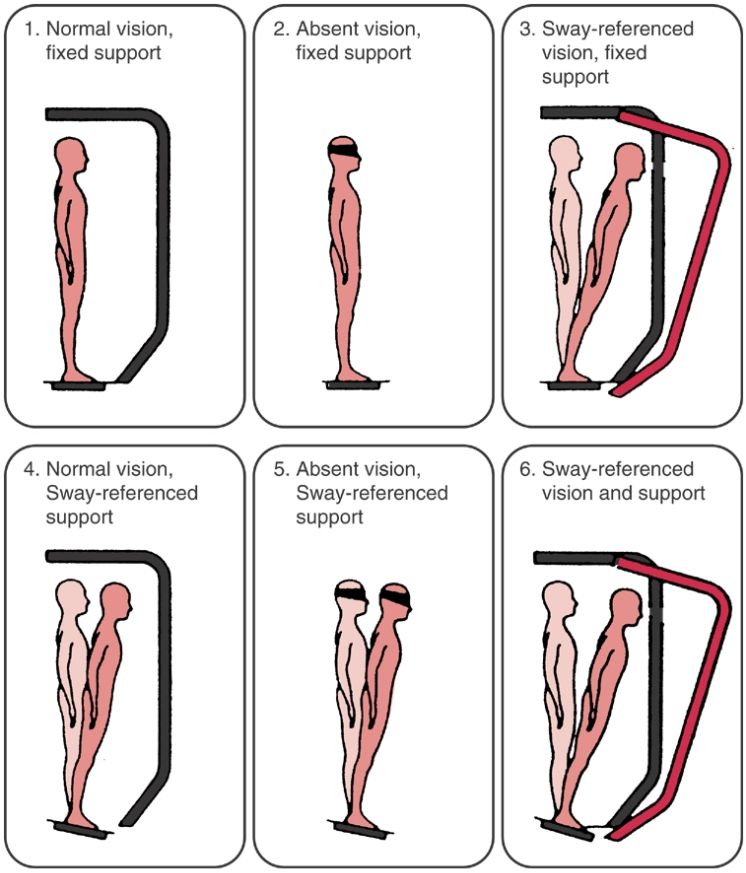
It is important to remember that safety is your first concern when testing balance. All patients should wear a gait belt during testing and be closely guarded at all times. In

determining what tasks and activities cause loss of balance, the patient must be allowed to experience instability. However, the therapist should protect the patient at all times to prevent a fall.

- Functional Level
  - Functional Balance Tests: Berg Balance Scale or Performance Oriented Mobility Test (Tinetti)
    - Steady-state components
    - Proactive (anticipatory) components
    - Reactive (adaptive) components

	Steady State	Reactive	Proactive
Standing Walking Sitting			

- Strategy Level
  - Sensory organization: vision, vestibular, somatosensory through the "foam and dome"



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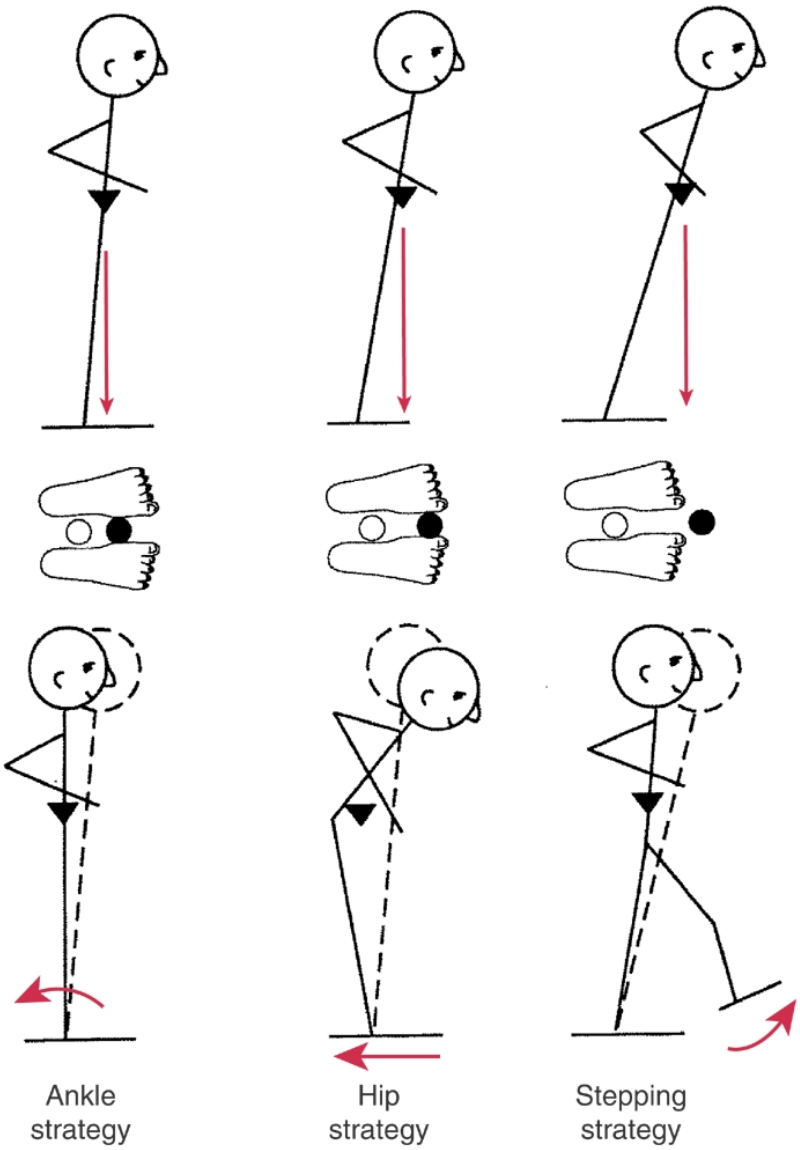
Patients who show increased amounts of sway or lose balance in conditions 2, 5 are thought to be visually dependent.
Patients who show increased amounts of sway or lose balance in conditions 4, 5 are thought to be surface dependent.
Patients who show increased amounts of sway or lose balance in condition 5 demonstrate a vestibular loss pattern.
Patients who show increased amounts of sway or lose balance in conditions 2, 4, 5 are thought to have a sensory selection problem.

✹Motor: stepping, hip, and ankle strategies to recover balance



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✹Cognitive: reduced awareness of safety/risk, dual task interference

- Underlying Impairments
  - Musculoskeletal impairments such as limited range of motion can affect balance through postural alignment and weight distribution
  - Neuromuscular impairments (weakness, abnormal tone, incoordination) can affect balance through motor, sensory, and cognitive systems

Treatment of Balance

Balance is often referred to as a composite impairment because it results from an interaction from multiple systems. Treatment of balance should be focused at both the impairment and functional levels. The purpose is to reduce or eliminate the underlying problems with weakness, abnormal tone, or incoordination that are contributing to poor balance and improve the patient's ability to sit, stand, walk, or transfer safely.

- Balance training requires practice, repetition, feedback, facilitation, function
- Target deficits with steady-state, proactive, reactive balance components as appropriate
  - Patient with too little force generation (Parkinson's disease) is directed towards achieving larger and faster sway movements during force platform training.
  - Patient with too much force generation (cerebellar ataxia) directed toward decreasing sway movements progressing to holding a stable, centered posture
- Practice purposeful body sway. Explore limits of stability
- A continuum of motor strategies should be present (ankle ↔ hip ↔ stepping) with selection specific to the demands of the task
  - Ankle strategy = utilized with small shifts in balance and/or slow body sway
  - Hip strategy = utilized with larger shifts in balance and/or faster body sway
  - Stepping strategy = very common; preferred over hip strategy; not a strategy of last resort (as previously thought)
  - Sidestepping = utilized with lateral perturbations
- Two main training strategies to promote reactive balance responses:
  - Manual perturbations or nudging
  - Moveable surfaces
- Sensory organization training
  - Vary vision: eyes closed/tricked
  - Vary sensory surfaces: floor, carpet, shoes, barefoot, sidewalk, grass, elevator
  - Vary attention demands: improve ability to maintain balance while performing other tasks that require attention (dual task interference)
- Active exercises to improve standing balance:
  - Calf stretch
  - Heel rise
  - Toe offs
  - Partial wall squats
  - Sit to stand (chair rises)
  - Side kicks
  - Back kicks
  - Marching in place
- Practicing tasks that are likely to produce instability:
  - Lifting
  - Reaching

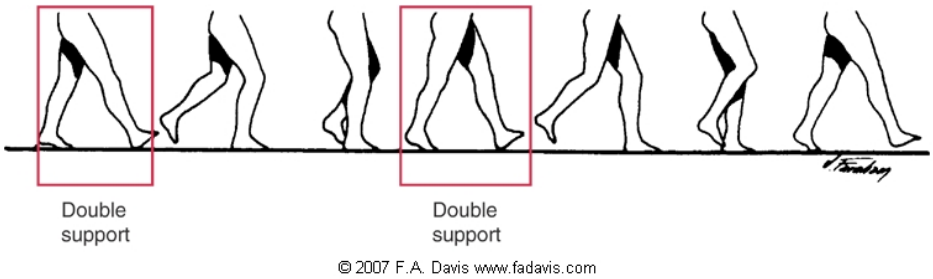
- Bending
- Throwing

- Walking on uneven terrain (safety issues)
- Walking on a treadmill (changing speeds)
- Unexpected obstructions (start/stop)
- Stepping up/down stairs/curbs
- Stepping over/around obstacles
- Carrying loads
- Walking inclines/declines

ABNORMAL GAIT

Examination of Gait

Traditionally, gait has been divided into stance and swing phases and analyzed by subset components such as heel strike, footflat, midstance, heel-off, and toe-off as well as acceleration, midswing, and deceleration. Other models prefer to categorize the motion of gait during double limb support (both feet on the ground) or single leg stance (one foot on the ground) plus swing limb advancement. There is no one/best way to analyze the gait cycle.



Subjective measurement: sample changes in gait associated with hemiplegia

SWING
- Limited knee flexion
- Limb circumduction
- Excessive ankle plantarflexion

STANCE
- Flatfoot/forefoot initial contact
- Knee hyperextension
- Excessive lateral pelvic rotation
- Lack of toe off
- Decreased hip extension
- Reduced ankle plantarflexion at push off

Objective measurement: gait speed is well-recognized as an important outcome measure

Gait speeds

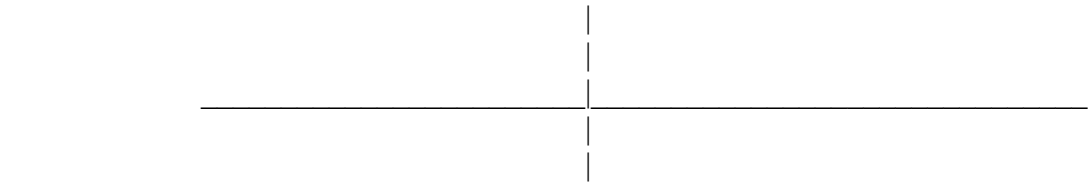
0.5 m/sec = minimally required speed for most community mobility
0.6 m/sec = red flag for fall risk
1.2 m/sec = typical person's walking speed/community ambulation speed
0.1 m/sec = significant change
1.0 m/sec = 2.25 miles/hour

Treatment of Gait
We will discuss further in the stroke section of the course.

Measurement of Impairments
Why do we measure impairments?
■Determine success of treatment
■Predict functional progress
■Measure change
■Make a diagnosis
■Make a prognosis

More and more, we are looking at changes in impairments as ways to make prognoses about the ultimate functional level the patient will reach. There have been several articles over the past few years in the literature on the relationship among impairments, functional limitations, and disability.

Relationship between improvement in impairments and functional gains



Here's an example of the relationship we expect between, say, increase in strength of certain leg muscles and the quality of ambulation. We expect that the patient needs to reach a certain level of strength before overcoming a gait defect.
In other words, function will lag behind reduction of impairment. As physiotherapists we make many assumptions that reduction of impairment is, in itself, a good thing often because we implicitly believe that the kind of relationship demonstrated on the graph above is true. But, as a field, we have not supported that yet with research. It is one of the reasons that the insurance companies have shifted the emphasis to functional change rather than change in impairment level.

Summary
■Impairments are changes at the organ or system level that occur as a result of pathology or trauma
■Central nervous system lesions can result in a wide variety of impairments including motor, sensory, cognitive, or perceptual
■A blend of special tests and clinical observation are available for assessing neuromuscular impairments such as weakness, abnormal tone, incoordination, balance problems, and abnormal gait
■Treatment options for neurological impairments are designed to facilitate normal movement or inhibit abnormal movement
■Impairments can be measured to determine the success of care, predict functional progress/prognosis, and to make a diagnosis.

Examining a Clinical Test of Balance

Objective: to examine a clinical test of balance using functional skills as a framework for identifying the underlying impairments of postural control.

Procedure: analyze the Berg Balance Scale or Performance Oriented Mobility Assessment (Tinetti). By each test item, indicate whether the task requires steady-state, reactive, or proactive postural control. Pay attention to the environmental conditions for each.

Assignment: Answer the following questions.

How many items test steady-state balance control?
Which ones?

How many test proactive balance control?
Which ones?

How many test reactive balance control?
Which ones?

Do any of the items examine the same task under different conditions?
Which ones?

Berg Balance Scale

GRADING: PLEASE MARK THE LOWEST CATEGORY THAT APPLIES.

1. Sitting to standing

Instruction: Use a chair with arms. Ask the patient to please stand up. If the patient stands up using the arms of the chair, ask the patient to stand up without using the hands if possible.

(4) Able to stand, no hands, stabilize independently
(3) Able to stand independently using hands
(2) Able to stand using hands after several tries
(1) Needs minimal assist to stand or to stabilize
(0) Needs moderate or maximal assist to stand

2. Standing unsupported

Instruction: Stand for 2 minutes without holding on to any external support.

(4) Able to stand safely 2 minutes
(3) Able to stand 2 minutes with supervision
(2) Able to stand 30 seconds unsupported
(1) Needs several tries to stand 30 seconds unsupported
(0) Unable to stand 30 seconds unassisted

IF SUBJECT IS ABLE TO STAND 2 MINUTES SAFELY, SCORE FULL MARKS FOR SITTING UNSUPPORTED. PROCEED TO POSITION CHANGE STANDING TO SITTING

3. Sitting unsupported, feet on floor

Instruction: Sit with arms folded for 2 minutes.

(4) Able to sit safely and securely for 2 minutes
(3) Able to sit 2 minutes with supervision
(2) Able to sit 30 seconds
(1) Able to sit 10 seconds
(0) Unable to sit without support for 10 seconds

4. Standing to sitting

Instruction: Please sit down.

(4) Sits safely with minimal use of hands
(3) Controls descent by using hands
(2) Uses back of legs against chair to control descent
(1) Sits independently but has uncontrolled descent
(0) Needs assistance to sit

5. Transfers

Instruction: Please move from this chair (chair with arm rests) to this chair (chair without arm rests) and back again.

(4) Able to transfer safely with only minor use of hands
(3) Able to transfer safely with definite need of hands
(2) Able to transfer with verbal cueing and/or supervision
(1) Needs one person to assist
(0) Needs two people to assist or supervise to be safe

6. Standing unsupported with eyes closed

Instruction: Close your eyes and stand still for 10 seconds.

(4) Able to stand 10 seconds safely
(3) Able to stand 10 seconds with supervision
(2) Able to stand 3 seconds
(1) Unable to keep eyes closed 3 seconds but stays steady
(0) Needs help to keep from falling

7. Standing unsupported with feet together

Instruction: Place your feet together and stand without holding on to any external support.
(4) Able to place feet together independently and stand 1 minute safely
(3) Able to place feet together independently and stand 1 minute with supervision
(2) Able to place feet together independently but unable to hold for 30 seconds
(1) Needs help to attain position but able to stand 15 seconds with feet together
(0) Needs help to attain position and unable to hold for 15 seconds

THE FOLLOWING ITEMS ARE TO BE PERFORMED WHILE STANDING UNSUPPORTED

8. Reaching forward with outstretched arm

Instruction: Lift arm to 90 degrees. Stretch out your fingers and reach forward as far as you can. Examiner places a ruler at end of fingertips when arm is at 90 degrees. Fingers should not touch the ruler while reaching forward. The recorded measure is the distance forward that the fingers reach while the subject is in the most forward leaning position.
(4) Can reach forward confidently more than 10 inches
(3) Can reach forward more than 5 inches safely
(2) Can reach forward more than 2 inches safely
(1) Reaches forward but needs supervision
(0) Needs help to keep from falling

9. Pick up object from floor

Instruction: Pick up the shoe/slipper that is placed in front of your feet
(4) Able to pick up slipper safely and easily
(3) Able to pick up slipper but needs supervision
(2) Unable to pick up but reaches 1-2 inches from slipper and keeps balance independently
(1) Unable to pick up and needs supervision while trying
(0) Unable to try; needs assist to keep from falling

10. Turning to look behind over left and right shoulders

Instruction: Turn to look behind you over your left shoulder. Repeat to the right.
(4) Looks behind from both sides and weight shifts well
(3) Looks behind one side only, other side shows less weight shift
(2) Turns sideways only but maintains balance
(1) Needs supervision when turning
(0) Needs assist to keep from falling

11. Turn 360 degrees

Instruction: Turn around in a full circle. Pause. Then turn a full circle in the other direction.
(4) Able to turn 360^0 safely in <4 seconds each side
(3) Able to turn 360^0 safely one side only in <4 seconds
(2) Able to turn 360^0 safely but slowly
(1) Needs close supervision or verbal cueing
(0) Needs assistance while turning

12. Count number of times step stool is touched

Instruction: Place each foot alternately on the stool. Continue until each foot has touched the stool four times for a total of eight steps.
(4) Able to stand independently and safely and complete 8 steps in 20 seconds
(3) Able to stand independently and complete 8 steps in more than 20 seconds
(2) Able to complete 4 steps without aid with supervision
(1) Able to complete fewer than 2 steps, needs minimal assist
(0) Needs assistance to keep from falling/unable to try

13. Standing unsupported, one foot in front

Instruction: (Demonstrate to subject) Place one foot directly in front of the other. If you feel that you cannot place your foot directly in front, try to step far enough ahead that the heel of your forward foot is ahead of the toes of the other foot.

(4) Able to place foot tandem independently and hold 30 seconds
(3) Able to place foot ahead of other independently and hold 30 seconds
(2) Able to take small step independently and hold 30 seconds
(1) Needs help to step but can hold 15 seconds
(0) Loses balance while stepping or standing

14. Standing on one leg

Instruction: Stand on one leg as long as you can without holding on to an external support.

(4) Able to lift leg independently and hold more than 10 seconds
(3) Able to lift leg independently and hold 5-10 seconds
(2) Able to lift leg independently and hold up to 3 seconds
(1) Tries to lift leg, unable to hold 3 seconds, but remains standing independently
(0) Unable to try or needs assist to prevent fall

TOTAL: /56 total pts

≥ 45 = less likely to fall
< 45 = more likely to fall

Reprinted with permission from Berg K. Measuring balance in the elderly: validation of an instrument. Dissertation. Montreal, Canada: McGill University, 1993.

Performance Oriented Mobility Assessment (Tinetti)

Balance Tests:
Initial instructions: Subject is seated in a hard, armless chair. The following maneuvers are tested.

1. Sitting balance
   Lean or slides in chair = 0
   Steady, safe = 1

2. Arises
   Unable without help = 0
   Able, uses arms to help = 1
   Able without using arms = 2

3. Attempts to arise
   Unable without help = 0
   Able, requires more than 1 attempt = 1
   Able to rise, 1 attempt = 2

4. Immediate standing balance (first 5 seconds)
   Unsteady (staggers, moves feet, trunk sway) = 0
   Steady but uses walker or other support = 1
   Steady without walker or other support = 2

5. Standing balance
   Unsteady = 0
   Steady, but wide stance (medial heels more than 4 inches apart) and uses cane or other support = 1
   Narrow stance without support = 2

6. Nudged (subject at maximum position with feet as close together as possible; examiner pushes lightly on subject's sternum with palm of hand 3 times)
   Begins to fall = 0
   Staggers, grabs, catches self = 1
   Steady = 2

7. Eyes closed
   Unsteady = 0
   Steady = 1

8. Turning 360 degrees
   Unsteady steps (grabs, staggers) = 0
   Discontinuous steps = 1
   Continuous steps = 2

9. Sitting down
   Unsafe (misjudges distances, falls into chair) = 0
   Uses arms or not a smooth motion = 1
   Safe, smooth motion = 2

Balance Score: /16

Gait Tests:
Initial instructions: Subject stands with the examiner, walks down hallway or across room, first at usual pace, then back at rapid, but safe pace (usual walking aids)

10. Initiation of gait (immediately after told to go)
    Any hesitancy or multiple attempts to start = 0
    No hesitancy = 1

11. Step length and height
    A. Right swing foot
        Does not pass left stance foot with step = 0
        Passes left stance foot = 1
        Right foot does not clear floor completely with step = 0
        Right foot completely clears floor = 1
    B. Left swing foot
        Does not pass right stance foot with step = 0
        Passes right stance foot = 1
        Left foot does not clear floor completely with step = 0
        Left foot completely clears floor = 1

12. Step symmetry
    Right and left step length not equal (estimate) = 0
    Right and left step appear equal = 1

13. Step continuity
    Stopping or discontinuity between steps = 0
    Steps appear continuous = 1

14. Path (estimated in relation to floor tiles, 12-inch diameter: observe excursion of 1 foot over about 10 feet of course)
    Marked deviation = 0
    Mild/moderate deviation or uses walking aid = 1
    Straight without walking aid = 2

15. Trunk
    Marked sway or uses walking aid = 0
    No sway, but flexion of knees or back or spreads arms out while walking = 1
    No sway, flexion, use of arms, or use of walking aid = 2

16. Step width
    Heels apart = 0
    Heels almost touching while walking = 1

Gait Score: /12

Balance and Gait Score: /28

Below 19	=	High risk of falling
19-24	=	Greater chance of falling but is not a high risk candidate
24-28	=	WNL

Reprinted with permission from Tinetti M. Performance-oriented assessment of mobility problems in elderly patients. *J Am Geriatr Soc* 1986;34:119-126.

CASE STUDY
Contributions of Impairments to Functional Limitations

OBJECTIVE: hypothesize what impact the neuromuscular impairments of this patient may have on two functional tasks.

You have received a PT order for a 19 year-old male who had a closed head injury 21 days ago in a moto accident. Information from the medical chart reveals the following: right-handed university student, lives with family, past medical history unremarkable. Information from your initial examination reveals the following about the patient:

> Able to follow one-step commands but is easily distracted and restless. Oriented to person and year, appears to be unaware of where he is or what has happened to him.
>
> PROM WNL except for the following: right shoulder external rotation is to 20°, flexion to 90°, abduction to 60°; right ankle dorsiflexion range is -10° from neutral.
>
> Muscle tone is normal on the left side and moderately increased in the right gastrocnemius, adductors, quadricpes, shoulder internal rotators, and biceps.
>
> Positive (+) Babinski sign bilaterally, 3-beat ankle clonus bilaterally, hyperactive deep tendons reflex on the right side.
>
> Formal manual muscle test is not valid due to cognitive deficits; however, strength appears to be grossly 4/5 on the left and 3/5 on the right.
>
> Unable to formally assess sensation due to cognitive deficits, however it appears to be diminished on the right (e.g., patient will roll onto right arm or sit on right hand and appears to be unaware).
>
> Exhibits intention tremor and dysmetria (poor accuracy) in the left arm.

Given your present knowledge, complete the grid below. How would you anticipate that each of the following impairments could affect this patient's ability to move from sit to stand and ambulate?

	Sit to Stand	Ambulate
Cognitive Status		
ROM Limitations		
Abnormal Tone		
Abnormal Reflexes		
Weakness		
Sensory Loss		
Incoordination		

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Homework Assignment #1

Your Name: _____

Date assignment is completed: _____

Please choose one patient and use this form to gather information on that patient. Please do not include the patient's name. Please bring this form back with you next month and be prepared to discuss the case.

You will receive 2.0 CPD units for completion of this homework assignment.

PATIENT DIAGNOSIS USING THE ICF MODEL

Pathology: _____

Impairments: _____

Functional Limitations (3): _____

_____

_____

Disabilities: _____

Please use the *Patient Specific Functional Scale* to help identify the *functional limitations* for this patient.

Advancement of Rwandan Rehabilitation Services Project

Neurology Course
Unit Two

Lesson Plans: Day 3

OBJECTIVES

1. Express your experience with communication disorders.
2. Examine the early warning signs, risk factors, behavioral differences, and long-term complications of stroke.
3. Identify guidelines for exercise prescription and monitoring response to physical activity following stroke.
4. Describe the components of a physiotherapy examination used to evaluate patients and establish a diagnosis post stroke.
5. Design a multi-level examination that uses the ICF model for a patient post stroke.
6. Evaluate patient data for diagnosis when given a clinical case study of an individual post stroke.

EXPERIENCING APHASIA

As a small group (4-5 people), play a game that asks you to read a set of unrelated words that, when read aloud, sound like familiar phrases, names, places, etc. Each person in the group should complete at least one card. We will discuss your thoughts on the experience as a large group.

EXAMINING THE CLINICAL MANIFESTATION OF STROKE

As a class, complete the worksheet, *Clinical Presentation of Stroke*, to examine clinical information pertinent to your care of individuals post stroke. We will discuss a sample of answers as a large group.

IDENTIFYING GUIDELINES FOR EXERCISE PRESCRIPTION FOLLOWING STROKE

Listen as we identify important cardiovascular and pulmonary parameters for exercise prescription following stroke. We will discuss your questions as a large group.

DESIGNING A MULTI-LEVEL EXAMINATION

Watch and listen to the slide show presentation on *Physiotherapy Examination of Stroke*. Follow along on the outline provided as we describe the components of a physiotherapy examination used to evaluate patients and establish a diagnosis post stroke. We will use video clips to view the movement patterns of a patient post stroke and design a multi-level examination using the ICF model. We will discuss your questions as a large group.

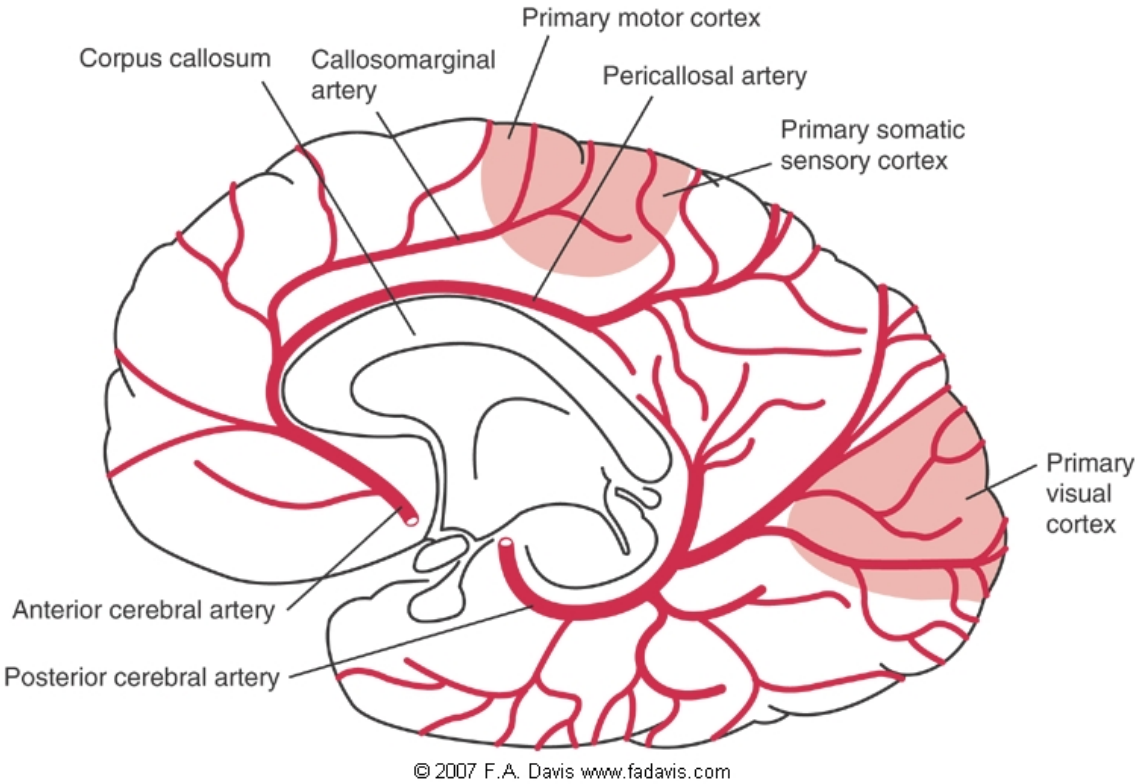
EVALUATING A PATIENT POST STROKE

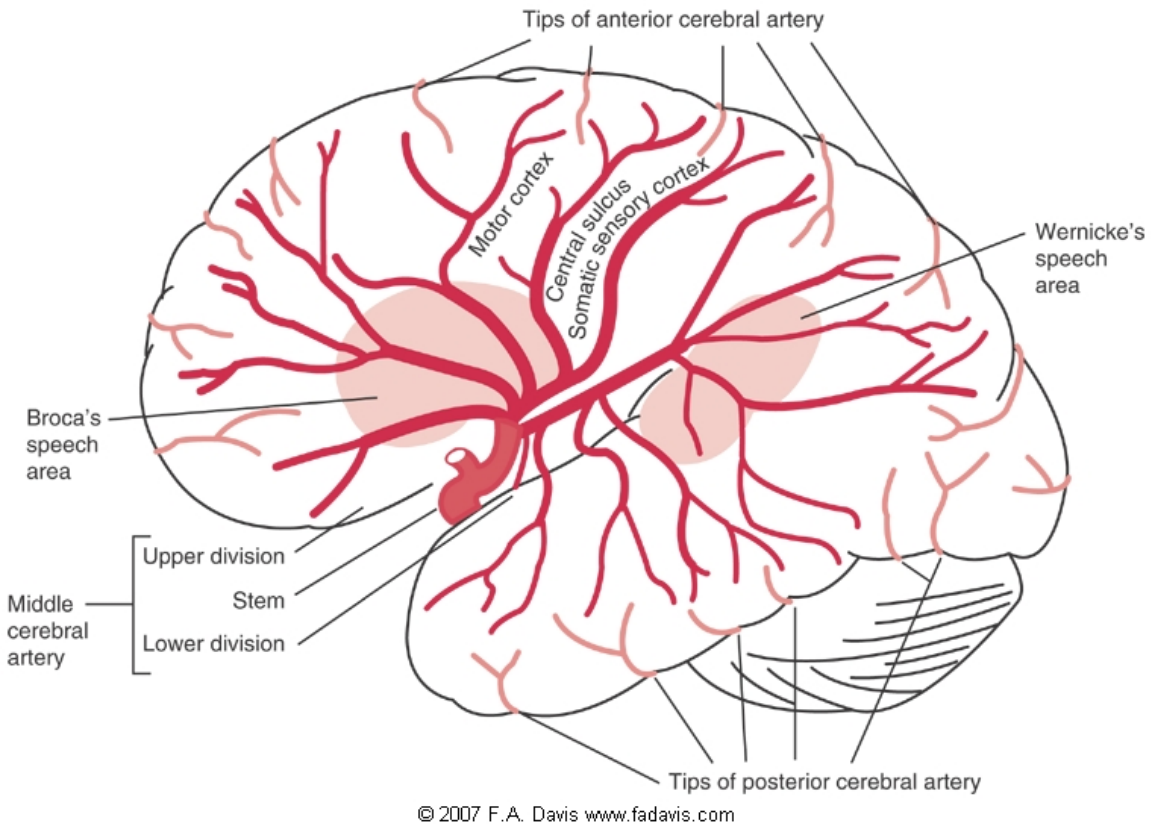
In your small groups (4-5 people), read the case study provided and answer the guiding question (#1). Each group will select a spokesperson to present their findings. We will discuss a sample of answers as a class at large.

Clinical Presentation of Stroke

OBJECTIVE: Examine the early warning signs, risk factors, behavioral differences, and long-term complications of stroke.

Stroke is the sudden loss of neurological function caused by an interruption of the blood flow to the brain. Ischemic stroke is the most common type and results when a clot blocks or impairs blood flow, depriving the brain of essential oxygen and nutrients. Hemorrhagic stroke occurs when blood vessels rupture, causing leakage of blood in or around the brain. The term cerebrovascular accident (CVA) is used interchangeably with stroke to refer to the vascular conditions of the brain. To be classified as a stroke, neurological deficits must persist for at least 24 hours. Motor deficits are characterized by paralysis (hemiplegia) or weakness (hemiparesis), typically on the side of the body opposite the side of the lesion. The term *hemiplegia* is often used generically to refer to the wide variety of motor problems that result from stroke. The location and extent of brain injury, the amount of collateral blood flow, and early acute care management determine the severity of neurological deficits in an individual patient. Impairments may resolve spontaneously as brain swelling subsides, generally within 3 weeks. Residual neurological impairments are those that persist longer than 3 weeks and may lead to permanent disability.





What are some of the early warning signs of stroke?

What are the <u>major</u> risk factors for stroke? <u>Minor</u> risk factors?

Match the following BEHAVIORAL differences attributed to damage of the left hemisphere, right hemisphere, or both hemispheres.

Unilateral neglect	RIGHT
Aphasia	
Difficulty sustaining a movement	
Difficulty planning a movement	
Visual field deficits	
Quick or impulsive behavior	
Slow or cautious behavior	
Difficulty grasping the big picture	
Disorganized problem-solving	
Poor judgment or unaware of impairments	
Anxiety over poor performance	
Emotional abnormalities	LEFT
(lability, apathy, irritability, frustration, depression)	
Rigid thinking, poor reasoning skills	
Delays in thought processing	
Difficulty expressing negative emotions	
Difficulty expressing positive emotions	
Difficulty processing visual cues	
Difficulty processing verbal cues	
Memory impairments of spatial or perceptual origin	
Memory impairments of language	
Cognitive deficits	BOTH
(confusion, attention, memory, executive function)	

Fill in the blank with the long-term complications that can result after a stroke.

Loss of voluntary movement and immobility following stroke can result in loss of range of motion and eventually _____ may develop, particularly in the paretic limbs. _____, _____, and _____ can result from inactivity and immobility. Early mobilization emphasizing out-of-bed upright postures and weightbearing activities along with forced use of the involved extremities are effective in counteracting these effects. _____, a bone disease characterized by a loss of bone mass is common in the elderly and results from decreased physical activity. _____ is also increased with a stroke due to multiple factors such as poor balance and difficulty walking. _____ are common after a stroke during the acute phase of recovery, but also can occur even several months after, and can be potentially life threatening if not controlled. _____ is excessive accumulation of cerebral spinal fluid (CSF) in the cranial cavity. It obstructs CSF circulation and requires surgery for draining or placement of shunt to resolve. _____ are potential complications for all immobilized patients. The hallmark clinical signs include rapid onset of unilateral leg swelling with dependent edema. The patient may report tenderness, a dull ache, or a tight feeling in the calf; pain is usually not severe. Sometimes no symptoms are present. _____ may restrict rehabilitation potential and requires careful monitoring and exercise prescription by the physiotherapist. _____, or the penetration of food, liquid, saliva, or gastric reflux into the airway, is common with dysphagia and can lead to acute respiratory distress, pneumonia, or death if left untreated. _____or _____ typically occur over bony prominences from pressure, friction, shearing, and/or maceration. _____ is an unusual motor behavior characterized by active pushing with the stronger extremities toward the hemiparetic side, leading to a lateral postural imbalance and a tendency to fall toward the weak side. It is caused by a severe misperception of body orientation in relation to gravity and can result in poorer rehabilitation outcomes (difficulty standing, transferring, walking), longer hospital stays, and prolonged recovery times.

EXERCISE GUIDELINES POST STROKE

OBJECTIVE: Identify guidelines for exercise prescription and monitoring response to physical activity following stroke.

Converging evidence suggests that aerobic exercise is a valuable intervention for improving brain function and could facilitate motor learning-related neuroplasticity for rehabilitation after stroke. However, cardiac or pulmonary limitations in exercise tolerance may restrict rehabilitation potential and requires careful monitoring and exercise prescription.

Target Heart Rate Range
Acceptable Range for Stroke Patient: 40-70% of predicted maximal heart rate
Maximal Heart Rate (HRmax) Equation: 208 – (0.7 x age)

Formulas for estimating heart rate are inaccurate in individuals using beta blockers or calcium channel blockers. Lower target heart rates may be indicated. For these individuals, the Borg Rating of Perceived Exertion (RPE) may be a better indicator of individual work level. Selection of RPE target should include consideration of individual's current fitness level and exercise tolerance.

Borg RPE Scale
Subjective ratings used by patients to describe how hard they feel they are working

6
7 Very, very light
8
9 Very light
10
11 Fairly light
12
13 Somewhat hard
14
15 Hard
16
17 Very hard
18
19 Very, very hard
20

Target Range: **11-14** with submaximal activity correlates to < 60% VO2 max

When to Monitor Physiologic Responses to Exercise and Physical Activity

- History of cardiac disease, valve dysfunction, angina, AND/OR other cardiac or pulmonary event.
- Presence of 2 or more risk factors for cardiac disease (example: smoking, hypertension, dyslipidemia, diabetes, obesity, stress, sedentary lifestyle, family history significant for cardiac disease, age: men ≥ 45, women ≥ 55)
- Any change in medication regimen
- Report of new symptoms
- Progression of exercise program in patient with 2 or more risk factors AND/OR previous cardiac or pulmonary events AND/OR low functional capacity.

Contraindications for Exercise or Physical Activity

SIGNS

- Resting HR > 100 bpm or <50 bpm
- Resting SBP > 200 mmHg or < 90 mmHg
- Resting DBP > 110 mmHg
- Oxygen Saturation < 90%
- Other: cyanosis, diaphoresis, bilateral edema in a patient with congestive heart failure (CHF), pallor, fever, weight gain > 1.8-2.7 kg/day, abnormal change in breath sounds or heart sounds

SYMPTOMS

- Shortness of breath, angina, dizziness, severe headaches, sudden onset of numbness or weakness, painful calf suggestive of DVT.

Indications to Terminate Exercise or Physical Activity

SIGNS

- HR: sudden drop > 15 bpm, change from regular to irregular rhythm, or exceeds HRmax
- SBP > 200 mmHg, decreases to < 90 mmHg, drop > 10 mmHg from resting or with increasing exercise
- DBP > 110 mmHg
- Oxygen Saturation < 90%
- Other: cyanosis, diaphoresis, bilateral edema in a patient with congestive heart failure (CHF), pallor, abnormal change in breath sounds or heart sounds, ataxia

SYMPTOMS

- Shortness of breath, angina, dizziness, severe headaches, sudden onset of numbness or weakness

Lab Values – Limitations for Exercise and Physical Activity

Type of Cell	Value	Therapy Implications
WBC	< 5000	No Exercise
	> 5000	Light exercise; progress to as tolerated
Hct	< 25%	No exercise
	> 25%	Light exercise
	30-32%	Add resistance as tol.
Hgb	< 8 g/dL	No exercise
	8-10	Light exercise
	> 10	No restriction
Platelets	< 20,000	AROM, maybe walking
	< 5,000	No exercise
PT	> 2.5 x norm	Therapy contraindicated
INR	> 2 w/o anticoag	Consult physician
	> 3	No exercise

	WBC	Hgb	Hct	Platelet
Male	5000-10,000	14-18	42-52	150,000-400,000
Female	5000-10,000	12-16	37-47	150,000-400,000

Blood Glucose

- Normal range adult without cardiac problems 3.3-6.0 mml/dL
- Should not exercise stroke patient with risk factors if <5.6 or > 13.9

Medications Affecting Responses to Exercise or Physical Activity

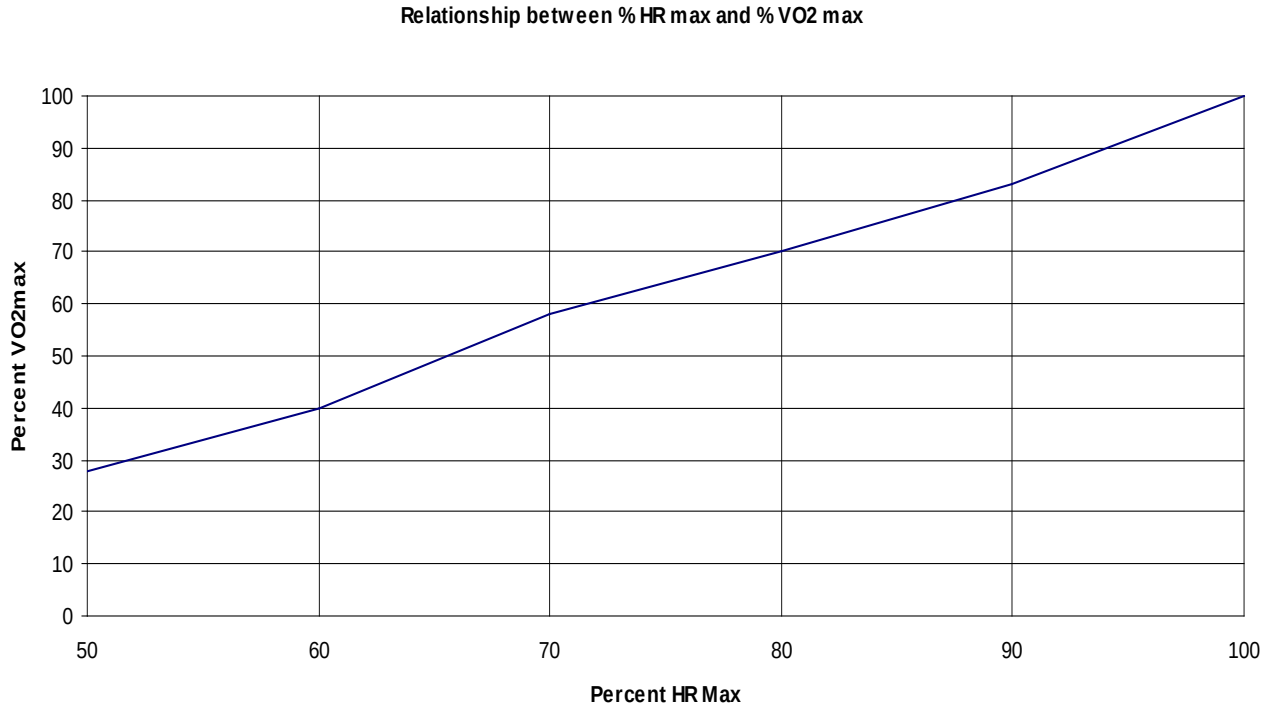
- Beta Blockers: blunts HR and BP responses
- Calcium Channel Blockers: decreases resting and exercise blood pressure response; may cause reflex tachycardia, edema, and/or post-exercise hypotension
- Digitalis: may cause dysrhythmias and/or tachycardia
- Bronchodilators: may increase HR and BP; may cause dysrhythmias
- Diuretics: may cause dysrhythmias; may cause fluid depletion or dehydration
- Vasodilators: may increase risk of post-exercise hypotension

Energy Costs of ADLs (MET Ranges)
Eating 1-2
Dressing/Bathing 2-3
Shower 3-4
Housework 3-5
Desk work 1.5
Ambulation
- 1.6 kph 1-2
- 3.2 kph 2-3
- 4.8 kph 3-3.5
- 5.6 kph 3.5-4
- 6.4 kph 5-6

Stairs 5-6
Dancing 3-7

How much is enough and why?
Minimum level of aerobic capacity compatible with independent living
- Men: 17.7 ml/kg/min (**5 METS**)
- Women: 15.4 ml/kg/min (**4.4 METS**)

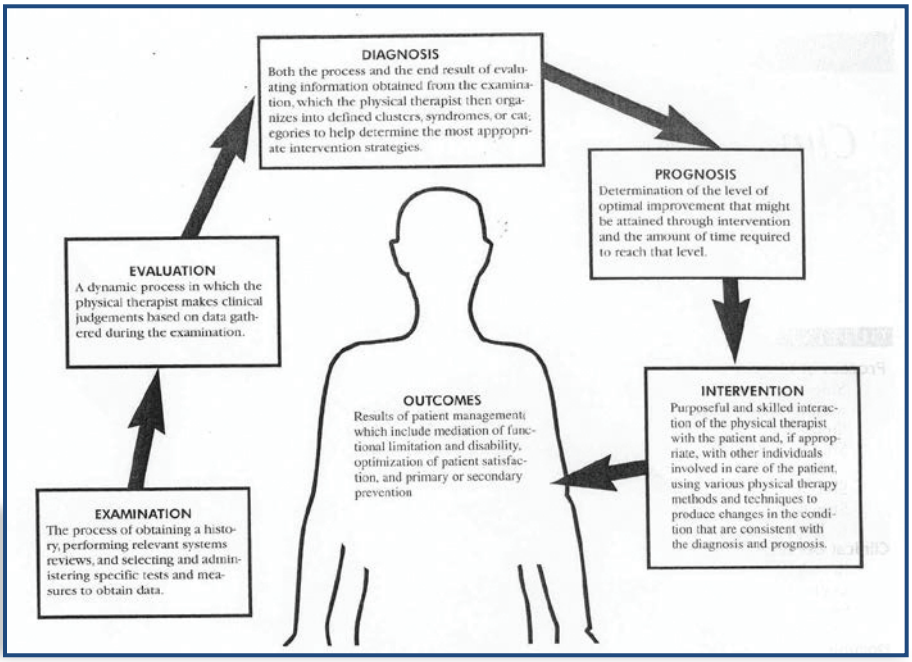
Another way to estimate the minimum level of energy required for independent living: Most of us function at 10-40% VO2 max for routine ADL activities and most adults ambulate at a speed that will keep the energy requirements < 40% VO2 max. We can not easily measure a person's VO2 max but we can estimate it by first calculating his/her HRmax using this formula: **% HRmax = actual HR / max HR**
Now look at the chart below to estimate %VO2 max.



Physiotherapy Examination of Stroke

Objectives

- Describe the components of a physiotherapy examination used to evaluate patients post stroke
- Establish a diagnosis for individuals post stroke



EXAMINATION

Pathology/Medical History

- Patient information: age, gender, etc.
- Diagnosis (medical) and current medical history
- Past medical history
- Social history (including prior level of function)

Impairments

- Consciousness
- Communication
- Cognitive, Emotional, Behavioral States
- Cranial Nerve Integrity
- Cardiovascular/Pulmonary Status (Vital Signs)
- Sensory Integrity
- Perception
- Joint Integrity/Mobility
- Tone/Reflexes
- Voluntary Movement Patterns
- Strength
- Balance/Coordination
- Gait

Functional Limitations
- Bed mobility
- Transfers
- Ambulating
- Wheelchair mobility

Disability
- Interact with others
- Access community
- Return to work
- Manage household

EVALUATION

Synthesize all of the findings from the history, systems review, and tests and measures to establish the diagnosis, prognosis, and plan of care.

DIAGNOSIS

Pathology ⇔ Impairment ⇔ Functional Limitations ⇔ Disability

Summary

- There are multiple levels of examination procedures.
- The selection of examination tests/measures will vary based on the patient's needs.
- Comprehensive examination provides the main source of information for clinical decision-making.

Stroke Patient
Case Study

OBJECTIVE
Evaluate patient data of an individual post stroke to determine diagnosis, plan of care, and appropriate motor learning strategies.

CASE STUDY
The patient is a 41-year old man admitted to hospital 10 days ago with a diagnosis of CVA (stroke) with right hemiparesis. Imaging consistent with a large left middle cerebral artery ischemic infarction. Past medical history includes seizure disorder since childhood, HTN (uncontrolled), and smoking x 20 years. Patient lives with his wife and 3 teenage children and was independent and active prior to stroke. He has a secondary school level of education and worked as a computer programmer. There are two steps to access single level home, which is rented. Patient is disoriented to time only and has good attention for about 30 minutes but shows difficulty following two- to three-step commands for motor responses. Patient is aphasic with severely decreased to nonfunctional verbal expression limited to occasional automatic words. Auditory comprehension has moderate to severe decrease in understanding words and simple concrete sentences; unreliable yes/no responses. Reading comprehension is severely decreased to nonfunctional at a word level. Unable to match word to object. Spontaneous use of gestures not evident. Patient complains of right shoulder pain at end ranges but PROM is within normal limits for both arms and legs except right dorsiflexion limited to 0-5 degrees. Right upper extremity has increased tone (moderate to severe) in elbow flexors, shoulder adductors, and internal rotators. Right lower extremity has increased tone (moderate) in hip and knee extensors and plantar flexors. The right upper extremity has partial motion (50% of range) in extensor synergy pattern (shoulder and elbow extension); no voluntary motion of hand; cannot perform flexor synergy pattern. Patient also demonstrates right upper extremity neglect and often lets the arm drop off the wheelchair. Right lower extremity has full motion in both extensor and flexor synergy patterns with extensor pattern dominating; extensor synergy achieved with associated reaction of right upper extremity extensor synergy. Left upper and lower extremities show full isolated movement with 5/5 strength and intact coordination. Sensation is difficult to determine due to communication deficits but there is no apparent sensation to sharp stimuli in the right upper/lower extremities. Patient demonstrates good head control and static sitting balance; able to maintain balance without external support and maintain midline orientation for 5 minutes. Weight shifting to limits of stability is reduced 50% to right but normal to left. Patient is able to stand unsupported independently in the parallel bars for 1 minute using left handhold but unable to weight shift to right without loss of balance. Left side weight shift is reduced 50%. Patient appears to have mild motor apraxia but tolerated 40-45 minutes of activity with occasional breaks/rests. Patient is motivated and cooperative. He appears anxious about his future and exhibited a brief episode of crying the previous day. Family is supportive and anxious to have him home again. Patient is able to roll to right independently using bed rail but requires minimal assistance to roll left. Supervision is required for scooting up in bed but minimal assistance for supine to/from sit. Patient is able to transfer bed to/from a chair with moderate assistance using a standing pivot

technique. He can propel a manual wheel chair 50 meters with supervision using Lt upper/lower extremity for propulsion. Ambulates 2-3 meters in the parallel bars with maximal assistance but has difficulty initiating movement with the right leg and requires manual contacts with right knee control to maintain extension. The right foot remains plantarflexed and supinated during stance with foot drop seen during swing. Patient is unable to climb stairs.

GUIDING QUESTIONS

1. Identify this patient's problems in terms of:

Impairments	Functional limitations	Disabilities

Write out a diagnosis statement that links pathology, impairment, functional limitations, and disability.

2. Identify anticipated goals (addressing impairments) and expected outcomes (addressing functional limitations) for this patient.

3. Formulate 5 treatment options with one progression that could be used during the first 3 weeks of therapy. Provide a brief rationale that justifies your choice.

Lesson Plans: Day 4

OBJECTIVES

1. Express your experience with fine and gross motor deficits.
2. Describe prognostic indicators, goals, and outcomes for individuals recovering from stroke
3. Identify common treatment options used by physiotherapists for individuals post stroke
4. Integrate active treatment approaches for hemiplegia with assisted sitting, standing, walking, and transitional movements.
5. Evaluate patient data to formulate a plan of care with appropriate treatment when given a clinical case study of an individual post stroke.

EXPERIENCING FINE AND GROSS MOTOR DEFICITS

As a small group (4-5 people), perform several tasks with simulated deficits in fine and gross motor skill. We will discuss your thoughts on the experience as a large group.

IDENTIFYING COMPONENTS OF PHYSIOTHERAPY TREATMENT OF STROKE

Watch and listen to the slide show presentation on *Physiotherapy Treatment of Stroke*. Follow along on the outline provided as we describe the prognostic indicators, goals/outcomes, and common treatment options used by physiotherapists for individuals post stroke. We will discuss your questions as a large group.

INTEGRATING ACTIVE TREATMENT APPROACHES FOR STROKE

With a partner, practice the techniques of active treatment approaches with hemiplegia demonstrated for assisted sitting, standing, walking, and transitional movements. We will discuss your questions as a large group.

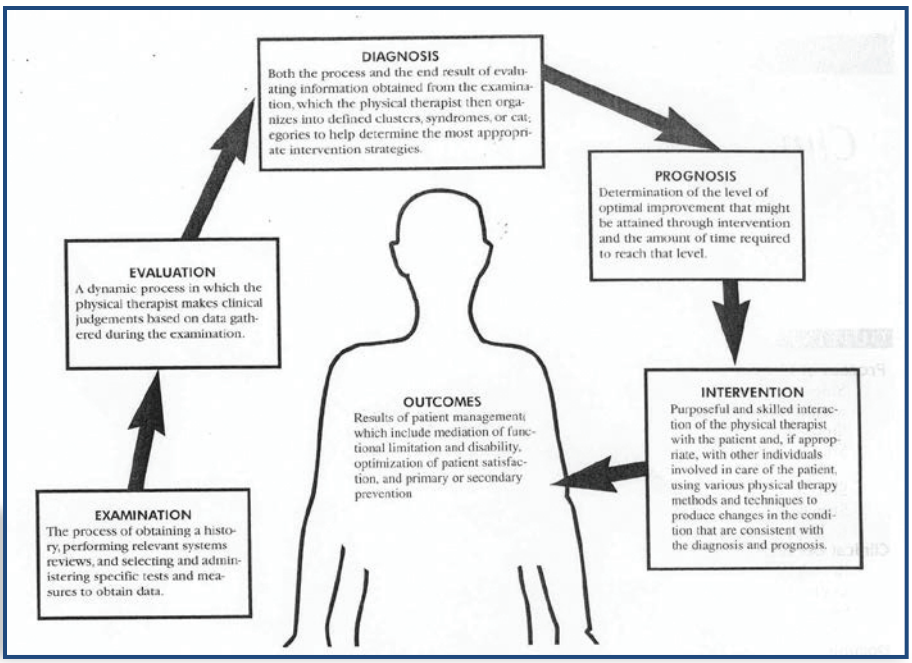
TREATING A PATIENT POST STROKE

In your small groups, review the case study provided and answer the guiding questions (2-3). Each group will select a spokesperson to present their findings. We will discuss a sample of answers as a class at large.

Physiotherapy Treatment of Stroke

Objectives

- Describe prognostic indicators, goals, and outcomes for individual's recovery from stroke
- Identify common interventions used by physiotherapists for individuals post stroke



PROGNOSIS

- Spontaneous resolution with decreased brain swelling, generally within 3 weeks
- Estimated 1/3 of stroke survivors are functionally dependent (example: difficulty with dressing or ambulating) after 1 year
- Pusher Syndrome associated with longer hospital stays, prolonged recovery times, lower functional scores on admission and discharge
- Recovery complicated by contractures, pain, edema, disuse atrophy, osteoporosis, falls, seizures, hydrocephalus, thrombophlebitis or deep vein thrombosis, cardiac or pulmonary limitations in exercise tolerance, aspiration pneumonia, skin break down or decubitus ulcers, urinary tract infections
- Recovery fastest in first weeks after onset with measurable neurological and functional recovery in the first month post stroke
- Functional gains may continue but at a reduced rate for months or years after stroke
- Prolonged recovery usually in the areas of language, vision, and perception
- Minor strokes recover rapidly with few or no residual deficits; severe strokes demonstrate significant impairments and prolonged recovery
- Motor function often improves after first few days and, along with perception, has the greatest impact on functional performance

•In cases of complete paralysis (hemiplegia) on admission, full motor recovery occurs in < 15% of patients

•Hendricks et al found no significant difference in potential for motor recovery between type of stroke (hemorrhage vs infarction) and location (brainstem vs hemispheric infarction).

Plan of Care

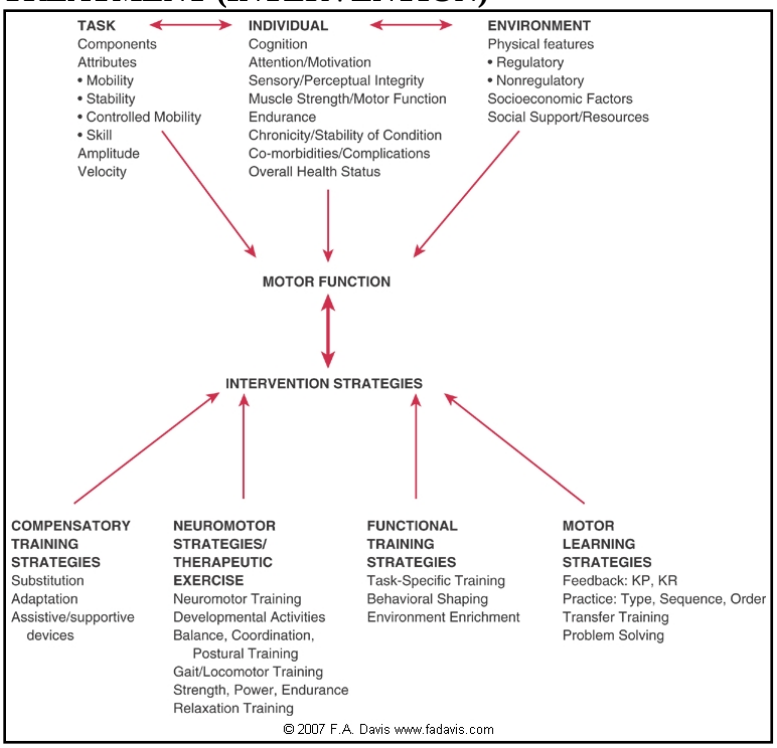
Sample Goals:

–↑ sensory awareness
–↑ perceptual function
–↑ strength
–↑ motor control
–↓ tone
–↑ ROM
–↓ pain
–↑ balance
–↑ gait

Sample Outcomes

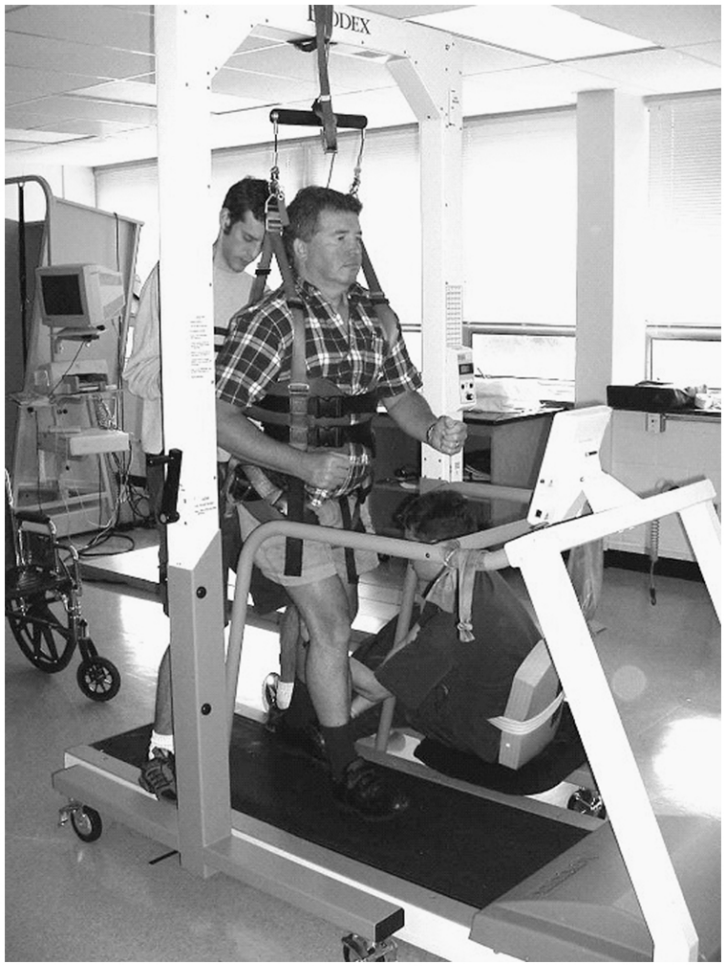
–↓ level of assistance or supervision for bed mobility, transfers, ambulating, climbing stairs
–↑ independence with ADL/IADL skills
–↑ tolerance of upright postures or activities
–↑ problem-solving, judgment, safety, or decision making skills

TREATMENT (INTERVENTION)



Neurorehabilitation approaches and therapeutic techniques for the patient with stroke have evolved over the years from a major emphasis on muscle reeducation initially developed for patients with poliomyelitis in the 1940s to the neurodevelopmental approaches first popularized in the 1950s and 1960s. These approaches include NDT (Bobath), Brunnstrom's Movement Therapy, PNF, and sensory stimulation techniques. Of these, NDT and PNF remain in popular use today. Currently there is increased emphasis on functional or task specific training using intense practice along with behavioral shaping and environmental enrichment to improve outcomes. Compensatory training strategies are also used in some circumstances to promote return of function using the less involved extremities. These are indicated for patients who demonstrate severe motor impairment and limited recovery.

Early attempts to validate the success of neurodevelopmental/facilitation approaches for the patient with stroke have failed to provide convincing evidence. Studies did not demonstrate significant advantages of one approach over another. Patients improved regardless of the type of intervention, thus providing evidence about the value of physiotherapy as a whole. Recent research continues to evaluate the effectiveness of facilitation approaches as well as strategies such as Constraint-Induced Movement Therapy and Locomotor Training Using Body Weight Support Treadmill.



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OUTCOMES

Documentation of daily progress as well as short-term goals and long-term outcomes can be in the following areas:

Sensory awareness
Perceptual function
Amount of verbal cues
Strength
Spasticity
Pain
Balance
Gait
Upper extremity function
Level of assistance required for transfers, ambulating, or climbing stairs
Activity tolerance

Remember you often measure outcomes with the same instruments, tests, or observations that you use for diagnosis and at the same level of disablement (example: impairment, functional limitation).

Summary

- Recovery from stroke is influenced by many factors
- Most patients with stroke regain some degree of independent living after rehabilitation
- Interventions seek to promote recovery and independence through remediation and compensation
- Various neuromuscular and sensory stimulation techniques can be utilized as therapeutic exercise to facilitate movement
- Developmental activities can help patients with neuromuscular disorders regain motor control
- Measurement consistency is one of the major problems with stroke outcomes

Active Treatment Approaches for Hemiplegia

OBJECTIVE: Integrate active treatment approaches for hemiplegia with assisted sitting, standing, walking, and transitional movements. *The following treatment approaches require facilitation as needed to increase postural or weight bearing symmetry. Hand placements will vary based on patient need and therapist preference.*

SITTING – Techniques to Facilitate Pelvic Tilt

Anterior Pelvic Tilt
Hand placement: lumbar spine; sternum; scapular squeeze

Posterior Pelvic Tilt
Hand placement: abdominals; pelvis

Lateral Pelvic Tilt
Hand placement: quadratus lumborum; sternum

Progression: Lateral Elbow Prop, Reaching

STANDING –Techniques to Facilitate Midline Orientation

Hand Placements: contralateral trunk, ipsilateral pelvis, ipsilateral leg block

Progression: Weight Shift, Reaching, Stepping

WALKING – Techniques to Facilitate One Step at a Time

Stance Phase

Transition from Swing Phase
Pause as therapist applies knee block
Activate quads to straighten knee
Activate gluts to extend hip (belly out)
Shift weight onto weak leg (load)
Advance Other Leg

Swing Phase

Shift weight (to strong leg)
Facilitate knee flexion
Activate hip flexion
Activate knee extension
Assist foot placement
Transition to Stance Phase

SCOOTING – Techniques to Facilitate Effective Movement Patterns

Hand Placements: contralateral trunk, ipsilateral pelvis, ipsilateral leg block

Forward

Backward

Lateral

TRANSFERS AND STANDING UP/SITTING DOWN

Dependent

Squat Pivot

Standing Pivot

ROLLING AND SUPINE TO/FROM SITTING

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Leg Hook

Hand Clasp

PROTECTING THE SHOULDER JOINT/UPPER EXTREMITY

Approximation of glenohumeral joint

Elbow/activation of triceps

Hand paddle

Weight bearing activity

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Homework Assignment #2

Your Name: _____

Date assignment is completed: _____

Please choose one patient and use this form to gather information on that patient. Please do not include the patient's name. Please bring this form back with you next month and be prepared to discuss the case.

You will receive 2.0 CPD units for completion of this homework assignment.

EVIDENCE OF TREATMENT PROGRESSION

Write down your initial treatment plan for a specific patient:

Write out an example of a progression of treatment that you used with this patient:

Explain how this progression challenged the patient more:

Advancement of Rwandan Rehabilitation Services Project

Neurology Course
Unit Three

Lesson Plans: Day 5

OBJECTIVES

1. Express your experience with a sudden interruption to an enjoyable task and with feeling lost, confused, or disoriented while performing a task.
2. Describe the key aspects of patient management for an individual with traumatic brain injury at Rancho Levels I-III and IV-VI.
3. Analyze patient treatment demonstrations with consideration for coma management and structured phases of recovery.
4. Evaluate patient data when given a clinical case study of an individual with traumatic brain injury at Rancho Level I-III and IV-VI.

EXPERIENCING A SUDDEN INTERRUPTION

As a group, we will participate in fun activity and experience a sudden interruption. We will discuss your thoughts on the experience as a large group.

DESCRIBING PATIENT MANAGEMENT FOR RANCHO LEVELS I-III

Watch a video clip and listen to the slide show presentation on *Physiotherapy Examination and Treatment of TBI Rancho Levels I-III: Coma Management Phase*. Follow along on the outline provided. We will discuss your questions as a large group.

ANALYZING COMA MANAGEMENT TREATMENT

Collaborate on a patient treatment session demonstrating the use of sensory stimulation and early transition to sitting postures to improve arousal. We will review the benefits of treatment as a large group.

EVALUATING A PATIENT WITH TBI (RANCHO LEVELS I-III)

In small groups, read Part A of the case study provided and answer the guiding questions (1-3). We will discuss a sample of answers as a class.

EXPERIENCING FEELING LOST, CONFUSED, OR DISORIENTED

As a group, we will explore several tasks with simulated cognitive, visual, or perceptual deficits. We will discuss your thoughts on the experience as a large group.

DESCRIBING PATIENT MANAGEMENT FOR RANCHO LEVELS IV-VI

Watch a video clip and listen to the slide show presentation on *Physiotherapy Examination and Treatment of TBI Rancho Levels IV-VI: Structured Phase*. Follow along on the outline provided. We will discuss your questions as a large group.

ANALYZING STRUCTURED TREATMENT

Collaborate on a patient treatment session demonstrating the use of structure and consistency to maintain function while preventing agitation. We will review the benefits of treatment as a large group.

EVALUATING A PATIENT WITH TBI (RANCHO LEVELS IV-VI)

In small groups, read Part B of the case study provided and answer the guiding questions (4-6). We will discuss a sample of answers as a class.

Physiotherapy Examination and Treatment
TBI Rancho Levels I, II, III - *Coma Management Phase*

Objectives

- Identify the components of a physiotherapy examination for the comatose patient
- Describe the categories of Level I, II, III on the Rancho Los Amigos Level of Cognitive Functioning scale
- Describe treatment options available to the physiotherapist working with an individual with traumatic brain injury at Rancho Levels I-III

Rancho Los Amigos Levels of Cognitive Functioning

The Rancho Scale is a descriptive scale used to examine cognitive and behavioral recovery from coma. It does not address specific cognitive deficits but is useful for communicating general cognitive and behavioral status and for treatment planning.

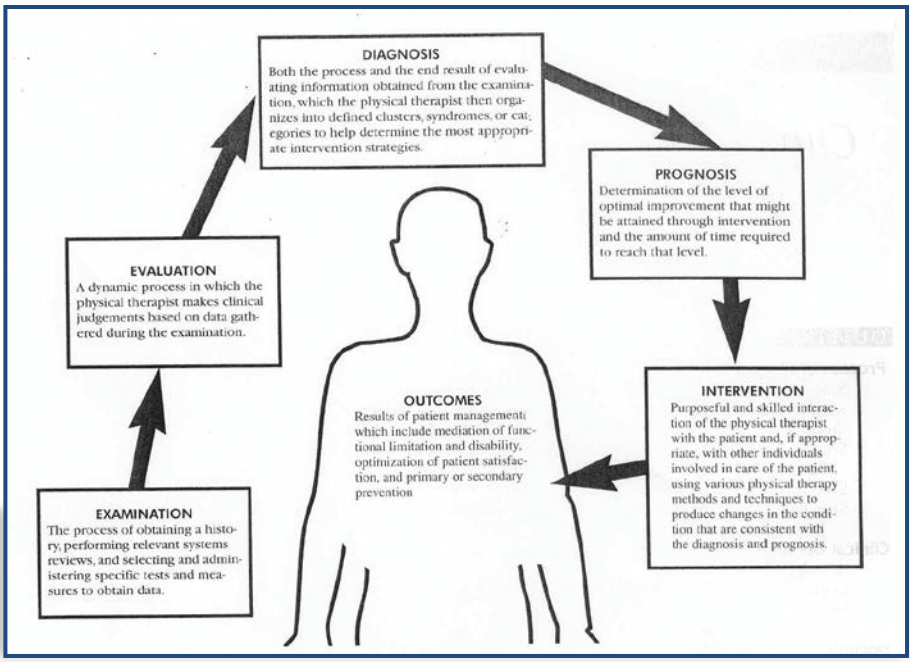
I	**No Response**
II	**Generalized Response**
III	**Localized Response**
IV	Confused-Agitated
V	Confused-Inappropriate
VI	Confused-Appropriate
VII	Automatic-Appropriate
VIII	Purposeful-Appropriate

Level I – No Response
Patient appears to be in a deep sleep and is completely unresponsive to any stimuli.

Level II – Generalized Response
Patient reacts inconsistently and nonpurposefully to stimuli in a nonspecific manner. Responses are limited and often the same regardless of stimulus presented. Responses may be physiological changes, gross body movements, and/or vocalization.

Level III – Localized Response
Patient reacts specifically but inconsistently to stimuli. Responses are directly related to the type of stimulus presented. May follow simple commands such as closing eyes or squeezing hand in an inconsistent, delayed manner.

Glasgow Coma Scale:	3 – 15
Severe brain injury (coma)	≤ 8
Moderate brain injury	9–12
Mild brain injury	13–15



EXAMINATION

*Check with primary physician or nurse for medical status prior to beginning any session. Often it may require several treatment sessions to complete the entire examination. Typically, activity is limited in patients with an unsecured aneurysm. All activities that increase BP (and, therefore, ICP) are limited to prevent rebleed. The patient should be maintained in a quiet environment with limited visitors until after aneurysm securement. After the aneurysm has been secured, patients gradually increase activity. Physiotherapists are consulted postoperatively when patients are stable. The initial management of patients suspected of having elevated ICP should include normal oxygenation monitored with pulse oximetry and arterial blood gases (**O2 saturation > 90%** or **PaO2 > 60 mm Hg**), and **systolic BP greater than 90 mm Hg**. **Head of bed** should be maintained at **30°,** and the patient's **head** should remain in **midline positioning, without jugular compression**, to promote venous return. Normal values for **ICP** are between **4 and 15 mmHg**. Medical intervention aims to maintain an **ICP below 20 mmHg**.*

Arousal/Attention/Cognition
- –**Rancho Level** and **GCS**
- –Response to sensory stimuli
- –Active movements

Circulation
- –Monitor vitals with positional changes or response to stimuli

Locomotion/balance
- –Sit up edge of bed, chair, or wheelchair
- –Transfer to chair or wheelchair

Integumentary integrity
- –Open wounds

Joint integrity/mobility

–Weight bearing restrictions
–External fixators
–Range of Motion restriction

Motor function
–Head/trunk control
–Muscle tone

Ventilation/Respiration
–Monitor vitals with positional changes or response to stimuli

EVALUATION

Synthesize all of the findings from the history, systems review, and test and measures to establish the diagnosis, prognosis, and plan of care.

DIAGNOSIS

Pathology ⇔ Impairment ⇔ Functional Limitation ⇔ Disability

PROGNOSIS

- Driven by initial severity of injury as measured on the Glasgow Coma Scale (motor response at 72 hours most predictive) and/or by length of posttraumatic amnesia
- Majority of recovery from coma occurs within the first 6 months to 1 year after trauma but some people persist in a vegetative state.
- Return to "normal" often prohibited by intellectual, behavioral, or physical disabilities
- Physical return does not necessarily mirror recovery on the Rancho scale
- Patients often move from one Rancho level to the next in stages but recovery may plateau at any level
- Other factors that may influence recovery are commonly associated injuries such as open wounds, fractures (open/closed), spinal cord injury, peripheral nerve damage, internal organ injury, and soft tissue injury.

Plan of Care

Sample Goal Areas:

↑ level of alertness or arousal
↑ purposeful movement
↓ risk of contractures, skin breakdown, pneumonia
↑↓ muscle tone
↑ pulmonary function

Sample Outcome Areas:

- Sitting balance is improved
- Head or trunk control is improved
- Purposeful movement is improved
- Level of assistance required for task performance is decreased
- Tolerance of positions (unsupported/supported) is increased

TREATMENT (INTERVENTION)

Therapeutic Exercise

- –PROM: results in no significant changes in ICP or CPP in stable, neurosurgical patients in the absence of intracranial hypertension

Functional Training

- –Positioning and handling techniques, transfer to sitting up at bedside or in wheelchair or chair, sitting activities with head/trunk control training

Assistive Devices and Equipment

- –Specialized air mattress, splints, multipodus boots, wheelchair, tilt table, serial casts

Airway Clearance Techniques

- –Postural drainage, percussion, vibration, positioning

Sensory Stimulation

- Auditory
  - –Conversation, music, TV
- Olfactory
  - –Favorite smells (example: coffee, perfume)
- Gustatory
  - –Food tastes
- Visual
  - –Photos, familiar objects
- Tactile, kinesthetic, vestibular
  - –ROM, turning, rolling, rocking, bathing, dressing, therapeutic guiding

Talk to the patient. Explain what you are doing. Provide orientation information. Constant background noise is undesirable due to competition between stimuli. Present the stimuli in an orderly manner with one or two modalities at a time to prevent over stimulation. Stimulation is most effective when administered for short treatment sessions (15-30 minutes). The effectiveness of this type of intervention is still in question (available evidence inconclusive). If available, consider a co-treatment with occupational or speech therapist to incorporate sensory stimulation. Remember nursing and family member education in all interventions!

OUTCOMES

Documentation of daily progress as well as short-term goals and long-term outcomes can be in the following areas.

- Sensory awareness is increased

Level of alertness is increased
Sitting balance is improved
Head or trunk control is improved
Purposeful movement is improved
Level of assistance required for task performance is decreased
Tolerance of positions is increased

Remember you often measure outcomes with the same instruments, tests, or observations that you use for diagnosis and at the same level of disablement (example: impairment, functional limitation).

Summary

- Rancho Levels I-III are considered coma management phases of rehabilitation
- Examination of individuals with TBI at Rancho Levels I-III centers on observation
- Treatment of individuals with TBI at Rancho Levels I-III focuses on improving arousal with early mobility and preventing complications due to immobility

Traumatic Brain Injury
Patient Case Study – Part A

OBJECTIVE
Evaluate patient data of an individual with traumatic brain injury during various stages of recovery.

CASE STUDY
The patient is a 34-year old female who was involved in a motor vehicle accident 6 weeks ago. The patient suffered a severe closed brain injury. She was taken to a local hospital. CT scan revealed a right temporal parietal hemorrhage, a left parietal hemorrhage, diffuse edema, and multiple contusions. Patient's eyes are open with random eye movements, but not able to track to auditory or visual stimuli. Patient does not blink eyes when startled. Patient does not respond to verbal commands. Patient not able to vocalize, or make any attempt at communication. Resting heart rate: 72, blood pressure: 124/72, respiration rate: 12. Patient presents with decorticate posturing and increased flexor tone in both arms rating 3 on left and 2 on right respectively as well as increased extensor tone in both legs rating 3 on left and 2 on right respectively. Patient has multi-beat continuous clonus left plantarflexors and 2-3 beat clonus right plantarflexors. Patient requires maximal assistance to sit on edge of bed and moderate assistance to maintain head control in sitting. Patient is dependent for rolling, moving to and from supine and sitting, transfers, and wheeled mobility. Patient is unable to stand. Patient has stage II wounds on both heels.

GUIDING QUESTIONS

1. Categorize the patient's level of consciousness and state her Rancho Level.

2. List this patient's neuromuscular impairments and functional limitations.

3. Describe 3 physiotherapy treatment options that would be appropriate for this patient at this time. Include at least one related to family education.

Physiotherapy Examination and Treatment
TBI Rancho Levels IV, V, VI – *Structured Phases*

Objectives

- Describe the categories of Level IV, V, VI on the Rancho Los Amigos Level of Cognitive Functioning scale
- Identify the components of a physiotherapy examination for the patient with traumatic brain injury needing structure
- Describe treatment options available to the physiotherapist working with an individual with traumatic brain injury at Rancho Levels IV-VI

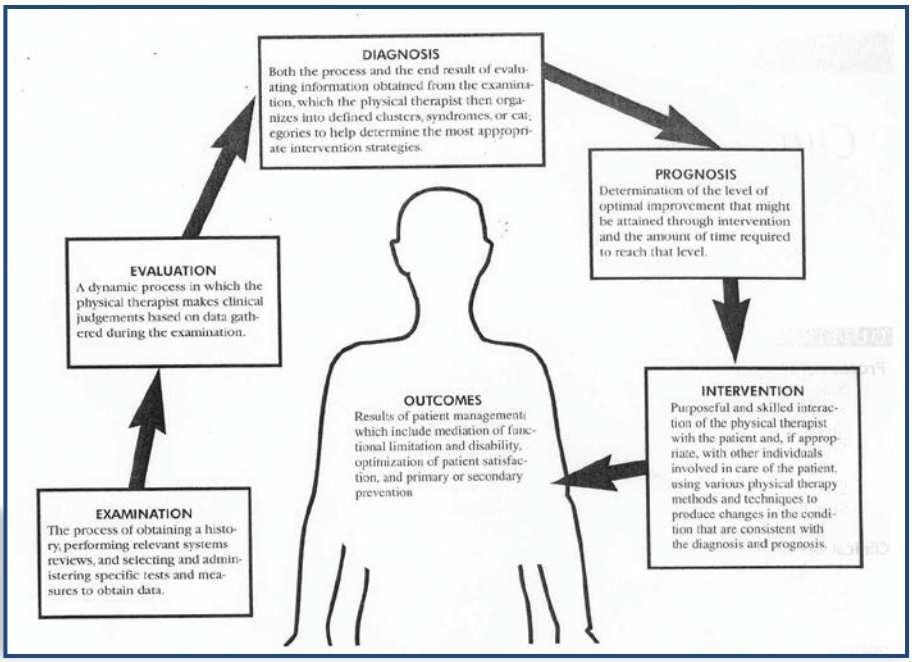
Rancho Los Amigos Levels of Cognitive Functioning

I	No Response
II	Generalized Response
III	Localized Response
IV	**Confused-Agitated**
V	**Confused-Inappropriate**
VI	**Confused-Appropriate**
VII	Automatic-Appropriate
VIII	Purposeful-Appropriate

Level IV – Confused Agitated
Patient is in a heightened state of activity. Behavior is bizarre and nonpurposeful relative to immediate environment. Does not discriminate among persons or objects; is unable to cooperate directly with treatment efforts. Verbalizations frequently are incoherent and/or inappropriate to the environment; confabulation may be present. Gross attention to environment is very brief; selective attention is often nonexistent. Patient lacks short- and long-term recall.

Level V – Confused Inappropriate
Patient is able to respond to simple commands fairly consistently. However, with increased complexity of commands or lack of any external structure, responses are nonpurposeful, random, or fragmented. Demonstrates gross attention to the environment but is highly distractible and lacks ability to focus attention on a specific task. With structure, may be able to converse on a social automatic level for short periods of time. Verbalization is often inappropriate and confabulatory. Memory is severely impaired; often shows inappropriate use of objects; may perform previously learned tasks with structure but is unable to learn new information.

Level VI – Confused Appropriate
Patient shows goal-directed behavior but is dependent on external input or direction. Follows simple directions consistently and shows carryover for relearned tasks such as self-care. Responses may be incorrect due to memory problems, but they are appropriate to the situation. Past memories show more depth and detail than recent memory.



EXAMINATION

Arousal/Attention/Cognition
- –Rancho Level
- –Alertness, orientation, attention span, memory, insight, safety awareness

Gait/Locomotion/Balance
- –Bed mobility, transfers (bed, chair, wheelchair), sitting, standing, ambulating, stair climbing, ADLs

Muscle Performance
- –Strength

Motor Function
- –Motor control
- –Balance
- –Coordination

Pain

ROM
- –PROM/AROM

Reflex Integrity
- –Reflexes
- –Tone

Sensory Integrity
- –Sensation

Level IV: As the patient begins to emerge from coma, he or she often experiences a period of acute posttraumatic agitation. The confusion, amnesia, and disorientation during Level IV often results in agitation, aggression, noncompliance, and combative behavior. Examples include verbally acting out, physically attempting to hurt themselves or others, and sexually inappropriate behavior. Because of the confusion, a patient may present with

poor memory, decreased attention span, and high distractibility. It may be difficult to gather data from exam because the patient will often be unable to cooperate; the therapist must utilize observation skills and the ability to estimate.

Levels V-VI: The patient is confused, but with structure is able to follow simple commands, which makes a more formal and accurate physiotherapy examination possible. The exam methods may need to be modified because the patient may still have difficulty when asked to perform complex tasks in an open environment. It is important to obtain concise and objective data at this point since accuracy may have been compromised during earlier attempts at data collection.

EVALUATION

Synthesize all of the findings from the history, systems review, and tests and measures to establish the diagnosis, prognosis, and plan of care.

DIAGNOSIS

Pathology ⇔ Impairment ⇔ Functional Limitations ⇔ Disability

PROGNOSIS

- Initial severity of injury
- Commonly associated injuries
- Lingering intellectual, behavioral, or physical disabilities
- Outcome measurements can help your predictions!

Two studies by Feld et al and Juneja et al demonstrated that the Berg Balance Scale, along with functional status measured using the FIM, was a useful method of predicting inpatient rehab length of stay, falls during rehabilitation stay, and functional gains during rehab.

Plan of Care

Sample Goal Areas:

- ↑ aerobic capacity
- ↑ balance
- ↑ strength
- ↑ ROM
- ↑ motor control
- ↓ tone
- ↓ pain

Sample Outcome Areas:

–↓ level of assistance or supervision for bed mobility, transfers, ambulating, climbing stairs

–↑ tolerance (behaviors) to interact with others, socialize, manage home environment, work

TREATMENT (INTERVENTION)

Therapeutic Exercise, Functional Training, Assistive Devices and Equipment

Creativity and flexibility

–Prepare numerous activities

–Treat patient at appropriate age level

–Give control when safe and appropriate

–Provide safe choices

Behavioral modification techniques

–Positive reinforcement

–Redirection

–Compliance training

Consistency

–Daily routine

–Same therapist

–Orientation information provided

Expect no carry over

–No new skills taught

–Memory aids for recall

Model calm behavior

–May reflect demeanor

Expect egocentricity

–Unable to see other points of view, don't stress them to do so

Safety

–1:1 staff supervision

–Wander guard

Patient/family education

–Aggressive behavior usually short lived (few weeks at most)

–Learn to assist patient as primary caregiver upon discharge home

For Rancho Level IV, the therapist should generally work near the patient's physical level of function and attempt to improve endurance, rather than progress to more challenging skills that would require new learning, as the patient does not have the ability for new learning at this level of recovery. The overall goal of physiotherapy for individuals with TBI at Rancho Level IV is to maintain functional capacity while preventing agitated outbursts.

For Rancho Levels V-VI, some of the same strategies regarding the patient's behavior should be considered as these individuals will still present with behavioral and cognitive deficits that will block relearning motor skills. Current theories of motor control and

motor learning suggest a task-oriented approach to interventions for individuals with neurological deficits. No matter which intervention technique is chosen, an emphasis should be placed on shaping the task to the patient's abilities (cognitive as well as physical) to optimize success while progressively increasing the complexity and demands of the task and relating the intervention to a meaningful functional goal. The overall goal of physiotherapy for individuals with TBI at Rancho Levels V-VI is to maximize functional recovery while preparing for discharge home and to the community.

OUTCOMES

Documentation of daily progress as well as STG and LTG can be in the following areas.

Safety awareness
Attention span
Orientation
Number of agitated outbursts
Amount of verbal cues
Standing balance
Level of assistance required for task performance
Tolerance of activities
PROM/Abnormal tone

Remember you often measure outcomes with the same instruments, tests, or observations that you use for diagnosis and at the same level of disablement (e.g., impairment, functional limitation) as well.

Summary

- Rancho Levels IV-VI are considered the structured phases of rehabilitation
- The overall goal of physiotherapy for individuals with TBI at Rancho Level IV is to maintain functional capacity while preventing agitated outbursts
- The overall goal of physiotherapy for individuals with TBI at Rancho Levels V-VI is to maximize functional recovery while preparing for discharge home and to the community

Traumatic Brain Injury
Patient Case Study – Part B

CASE STUDY

The patient is now out of coma and has continued to progress. She is still in the hospital and it is now 7 weeks later, 13 weeks post-injury. The patient still presents with increased tone in the left leg in an extensor pattern and the left arm in a flexor pattern rating 2 on Modified Ashworth scale. The right arm and leg no longer present with tone/abnormal patterns and have full AROM and 4/5 strength observed for all muscle groups. The patient exhibits partial AROM against gravity in the left arm and leg for all muscle groups except ankle dorsiflexion is 1/5. Patient exhibits impaired coordination in all four extremities with the left worse than the right with delayed initiation of movement, slower speeds and poor accuracy. Client also exhibits a minimally ataxic gait pattern. Sensation is intact throughout for light touch, pinprick, deep pressure, and proprioception. Patient is able to maintain static sitting balance and reach slightly outside base of support. In standing, patient is able to maintain unsupported posture for 5 minutes with minimal assistance but shows decreased weightbearing on left leg. The Berg Balance Scale score is 8/56. Patient exhibits protective reactions and righting reactions in sitting but both are delayed on left and right and slower on left than right. Reactions are similar but worse in standing. Patient is able to roll independently to the left but requires minimal assistance to the right. Patient requires minimal to moderate assistance to transition supine to sit but only supervision for sit to supine, mainly verbal cues for correct technique. Patient can transfer bed to and from wheelchair with moderate assistance using standing pivot to left or right as well as verbal cues to correctly positioning wheelchair and lock brakes. Patient is able to propel a manual wheelchair 50 meters with supervision and verbal cues using both legs to propel. Patient is able to ambulate 35 meters with moderate assistance using a forearm crutch in the right hand and a left hinged ankle foot orthosis (AFO). Patient is unable to climb stairs at this time. Patient exhibits short-term memory impairments. She is inconsistently disoriented to place and time and oriented to person 100% of time. Patient is able to follow two- to three-step commands when in a closed environment. When in an open environment, the patient is only able to follow one-step commands. Patient exhibits decreased insight into impairments and diminished safety awareness. Patient is easily distracted, able to attend to a task for only 5 minutes at best. Patient exhibits expressive aphasia. She is able to make basic needs known using verbal language and gestures. She exhibits severe word retrieval deficits. Her receptive language skills are normal.

GUIDING QUESTIONS

1. Describe how this patient's memory impairments will affect physiotherapy treatment options and how the physiotherapist should adapt them to maximize the patient's motor learning abilities?

2. List three (3) possible short-term goals for this patient.

3. Describe one (1) possible long term outcome for this patient.

Lesson Plans: Day 6

OBJECTIVES

1. Describe the key aspects of patient management for an individual with traumatic brain injury at Rancho Level VII-VIII.
2. Evaluate patient data when presented with a clinical case study on an individual with traumatic brain injury at Rancho Level VII-VIII.
3. Integrate guided movement techniques to facilitate function in individuals with traumatic brain injury.
4. Review the skills and functions associated with the lobes of the brain.
5. Examine cognitive and perceptual dysfunction relevant to working with traumatic brain injury.
6. Assess ways to implement intensity in your treatment session.

DESCRIBING PATIENT MANAGEMENT FOR RANCHO LEVELS VII, VIII

Watch a video clip and listen to the slide show presentation on *Physiotherapy Examination and Treatment of TBI Rancho Levels VII-VIII: Community Reintegration*. Follow along on the outline provided. We will discuss your questions as a large group.

EVALUATING A PATIENT WITH TBI (RANCHO LEVELS VII-VIII)

In small groups, read Part C of the case study provided and answer the guiding questions (7-8). We will discuss a sample of answers as a class.

INTEGRATING GUIDED MOVEMENT TECHNIQUES FOR TBI

With a partner, practice the techniques of guided movement to assist individuals with decreased comprehension, increased confusion, or visual/perceptual deficits. We will discuss your questions as a large group.

REVIEWING SKILLS AND FUNCTIONS ASSOCIATED WITH BRAIN LOBES

Watch and listen to the podcast, *Traumatic Brain Injury Effects of Damage to Different Lobes of the Brain*. Follow along on the outline provided. We will discuss your questions as a large group.

EXAMINING COGNITIVE AND PERCEPTUAL DYSFUNCTION

Listen as we examine cognitive and perceptual dysfunction relevant to working with individuals post traumatic brain injury. We will discuss your questions as a large group.

ASSESSING WAYS TO IMPLEMENT INTENSITY

Watch as we view a patient video and listen as we identify possible ways to implement intensity in your treatment sessions. We will discuss your questions as a large group.

Physiotherapy Examination and Treatment
TBI Rancho Levels VII-VIII – Community Reintegration

Objectives

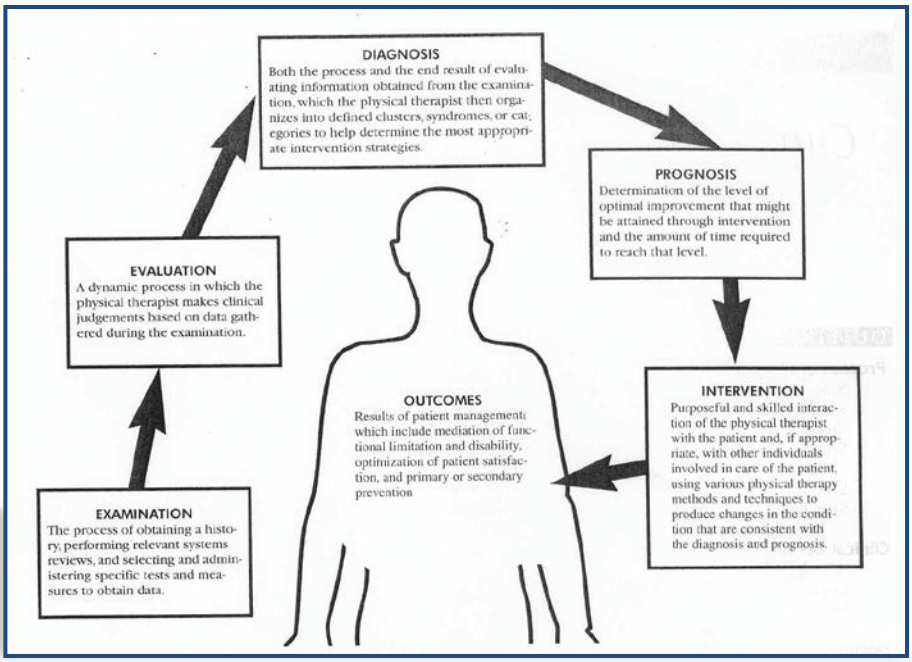
- Describe the categories of Level VII-VIII on the Rancho Los Amigos Level of Cognitive Functioning scale
- Identify the components of a physical therapy examination for the patient with traumatic brain injury at Rancho Levels VII-VIII
- Describe treatment interventions available to the physical therapist in working with an individual with traumatic brain injury at Rancho Levels VII-VIII

Rancho Los Amigos Levels of Cognitive Functioning

I	No Response
II	Generalized Response
III	Localized Response
IV	Confused-Agitated
V	Confused-Inappropriate
VI	Confused-Appropriate
VII	**Automatic-Appropriate**
VIII	**Purposeful-Appropriate**

Level VII – Automatic Appropriate
Patient appears appropriate and oriented within the hospital and home settings; goes through daily routine automatically, but frequently like a robot. Patient shows minimal to no confusion and has shallow recall of activities. Shows carryover for new learning but at a decreased rate. With structure is able to initiate social or recreational activities; judgment remains impaired.

Level VIII – Purposeful Appropriate
Patient is able to recall and integrate past and recent events and is aware of and responsive to environment. Shows carryover for new learning and needs no supervision once activities are learned. May continue to show a decreased ability relative to premorbid abilities, abstract reasoning, tolerance for stress, and judgments in emergencies or unusual circumstances.



EXAMINATION

At these levels of recovery, the restoration of physical function is not significantly different from the preceding level. The same examination procedures discussed in Levels V-VI should be used. [Remember: a more formal and accurate physical therapy examination is now possible].

Arousal/Attention/Cognition
- –Rancho Level
- –Alertness, orientation, attention span, memory, insight, safety awareness

Gait/Locomotion/Balance
- –Bed mobility, transfers (bed, chair, wheelchair), sitting, standing, ambulating, stair climbing, ADLs

Muscle Performance
- –Strength

Motor Function
- –Motor control
- –Balance
- –Coordination

Pain

ROM
- –PROM/AROM

Reflex Integrity
- –Reflexes
- –Tone

Sensory Integrity
- –Sensation

EVALUATION
Synthesize all of the findings from the history, systems review, and tests and measures to establish the diagnosis, prognosis, and plan of care.

DIAGNOSIS
Pathology ⇔ Impairments ⇔ Functional Limitations ⇔ Disability

PROGNOSIS
- Initial severity of injury
- Commonly associated injuries
- Lingering intellectual, behavioral, or physical disabilities
- Outcome measurements

Plan of Care
Sample Goals:
- ↑ aerobic capacity
- ↑ balance
- ↑ strength
- ↑ ROM
- ↑ motor control
- ↓ tone
- ↓ pain

Sample Outcomes
- Able to perform bed mobility, transfers, ambulating, climbing stairs
- Relate to community tasks such as food preparation, housekeeping, shopping, accessing public transportation, working, etc.

TREATMENT (INTERVENTION)
Therapeutic Exercise, Functional Training, Assistive Devices and Equipment
Emphasis
- Community re-entry
- Return to work/school
- Cognitive, behavioral, psychosocial issues

Major goal
- Integrate cognitive, physical, emotional skills
- Function in community

Skill development
- –Judgment
- –Problem solving
- –Planning
- –Self awareness
- –Health and wellness
- –Social interactions

Treatment focus
- –Community skills
- –Social skills
- –Daily living skills

Prior to discharge, it is crucial to begin to wean the patient from the external structure provided by the hospital setting that was so important in the early stages of recovery. The emphasis of therapeutic intervention is now on community re-entry, return to work or school, and cognitive, behavioral, and psychosocial issues. It is important to involve the individual in decision-making. Independent as well as cooperative work with others is encouraged. Group treatment sessions are often the basis of interventions. Honest feedback from the therapist and support group is crucial for the patient to learn how to function in society with his or her present abilities and limitations. Trial periods of independent living and supported work are important.

OUTCOMES

Documentation of daily progress as well as STG and LTG can be in the following areas.

- Safety awareness
- Attention span
- Amount of verbal cues
- Level of supervision
- Level of assistance required for task performance
- Ability to perform physical tasks related to ADL skills, community and work, and leisure activities
- Self-management of symptoms

Remember you often measure outcomes with the same instruments, tests, or observations that you use for diagnosis and at the same level of disablement (e.g., impairment, functional limitation) as well.

Summary

- Rancho Levels VII-VIII are considered the community reintegration phases of rehabilitation
- The overall goal of physiotherapy for individuals with TBI at Rancho Level VII-VIII is to assist the patient in integrating the cognitive, physical, and emotional skills necessary to function in the community.

Traumatic Brain Injury
Patient Case Study – Part C

CASE STUDY

It is now approximately 5 months after the initial accident. The patient is now discharged home with her husband. She requires 24-hour supervision due to continuing cognitive, communication, and mobility impairments. She presents to the hospital to participate in outpatient therapy. The patient now has normal muscle tone in all extremities. Her coordination is still impaired in both arms and legs with slow movement, decreased accuracy (greater on left than right), and a minimally ataxic gait pattern. Strength is within normal limits for all muscle groups except dorsiflexors are 4+/5 on the right and 3+/5 on the left. Passive ROM is within normal limits for all four extremities except dorsiflexion 0-10 degrees on right and 0 degrees on left. Patient is able to sit with static and dynamic postural control intact. With standing balance, she is able to maintain postural control with minimal challenges; dynamic balance is moderately impaired with a Berg Balance Scale score: 40/56. Patient is able to roll left and right independently as well as move supine to/from sit without assistance. Transfers wheelchair to/from bed require supervision with one to two verbal cues for safety and locking brakes. Floor to stand transfers require moderate assistance. Wheelchair mobility is independent in the home. Ambulation is supervised for 90 meters in a closed environment (home or hospital) with bilateral hinged AFOs. Patient uses a forearm crutch in the right hand. In an open environment, the patient requires contact guard assistance (CGA) to ambulate; gait speed is 0.65 m/sec; gait endurance over a 6-minute walk is 175 meters. Stairs require CGA up and down one flight with bilateral AFOs and one railing. Patient is oriented to person, place, time 100%. While she has shown improvement in short-term memory and new learning, she is still impaired in this area. She is able to follow four- to five-step commands in a closed environment. Patient performs best in a highly structured environment. In an open environment, patient becomes easily distracted, needing verbal cues to complete a task. Patient's insight and safety awareness have improved, but are still impaired. For example, she requires verbal reminders not to transfer or ambulate alone. Patient exhibits moderate word finding deficits and an inability to remember names of objects.

GUIDING QUESTIONS

4. List and prioritize the patient's impairments and functional limitations.

5. Describe 2 treatment options appropriate for this patient. At least one should focus on community reentry.

GUIDED MOVEMENT TECHNIQUES

Objective: integrate guided movement techniques to facilitate function in individuals with traumatic brain injury.

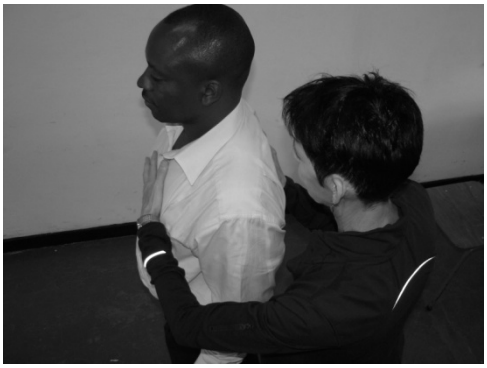
Indications: used for patients with decreased comprehension, increased confusion, or visual perceptual deficits.

The goals of using the therapist's hands during therapeutic treatment are:

1. To guide or assist the patient during functional movements
2. To control specific patterns of movement
3. To give the patient the sensory input or feedback for correct movement control
4. To allow patients to experience the functional movements that will encourage them to move from one position to another
5. To create a limited environment where patients can succeed at the desired task

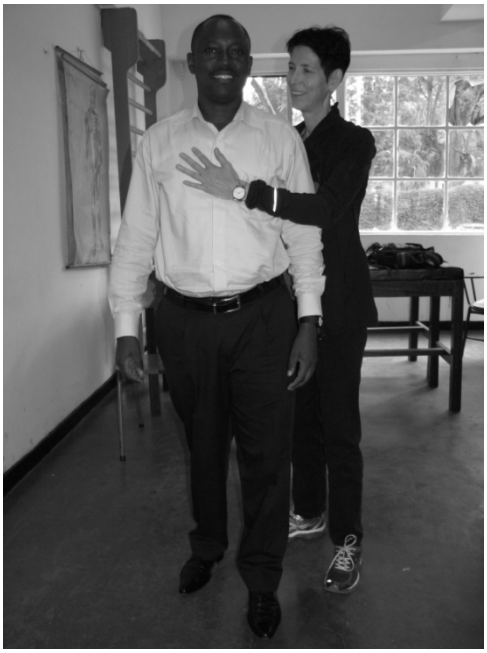
The therapist guides the patient's own extremity on body movements or uses key points on the trunk and pelvis. The patient receives proprioceptive and kinesthetic feedback as he or she performs a functional task.

Thoracic Spine Points of Control



Pelvic Points of Control

Walking



Sidestepping

Sitting to/from Standing

Ball Toss

Functional Patterns

Traumatic Brain Injury
Effects of Damage to Different Lobes of the Brain

Frontal Lobe

- Sequencing
- Decision Making
- Attention
- Personality
- Problem Solving
- Verbal Expression
- Spontaneity
- Emotions
- Movement Initiation

Temporal Lobe

- Spoken Word
- Selective Attention
- Sexuality
- Inhibitions
- Aggression
- Identification
- Categorization
- Facial Recognition
- Locating Objects

Parietal Lobe

- Object Classification
- Tactile Processing
- Academic Skills
- Cognitive Ability
- Directional Understanding
- Hand-Eye Coordination
- Spatial Orientation

Occipital Lobe

- Vision
- Visual Field
- Locating Objects
- Color Identification
- Hallucinations
- Word Blindness
- Movement Perception
- Reading/Writing
- Visual Processing

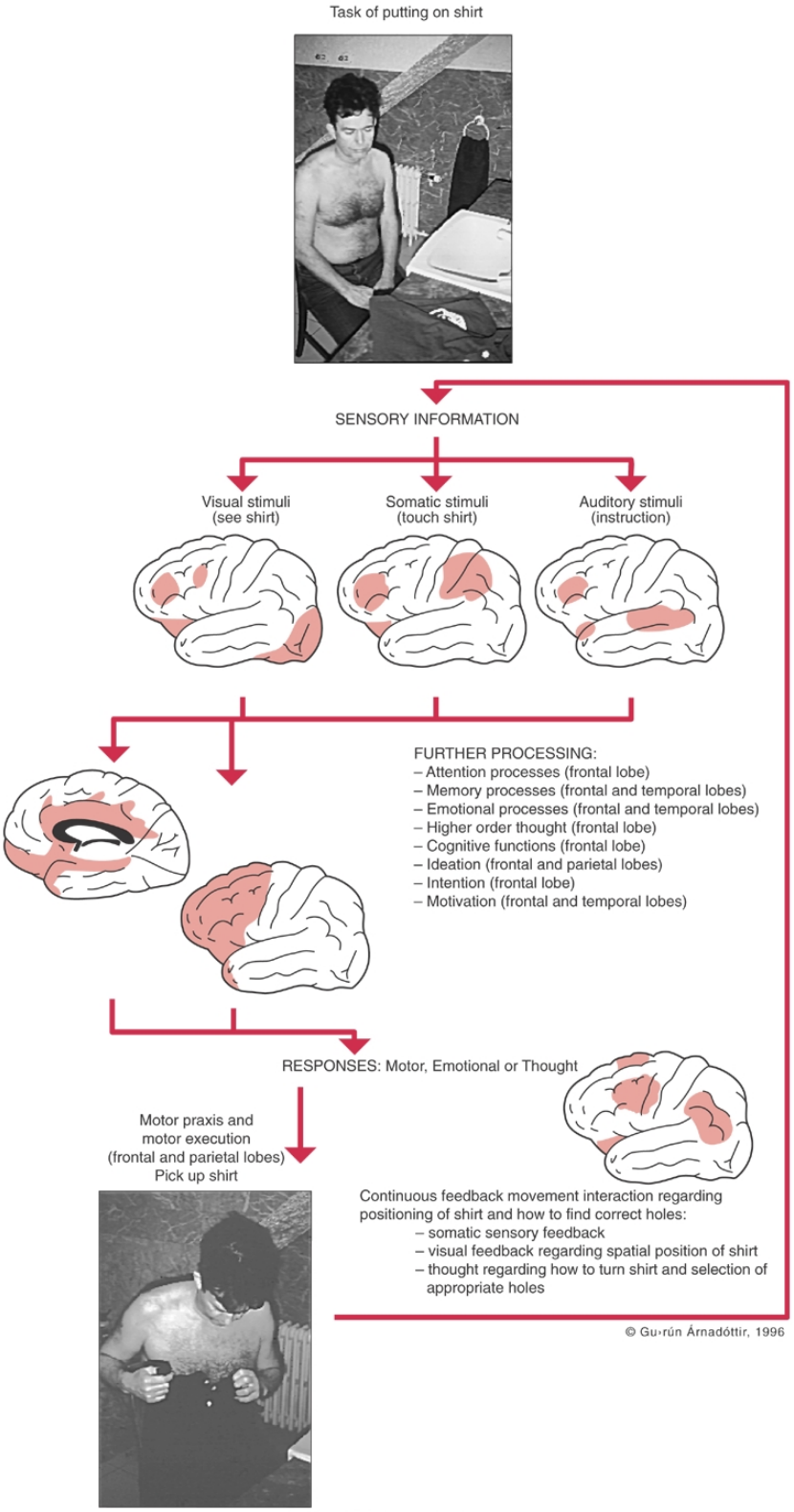
Cerebellum

- Gross & Fine Motor Skills
- Voluntary Motor Skills
- Balance
- Equilibrium
- Coordination
- Postural Controls
- Eye Movements

Brain Stem

- Body Temperature
- Heart Rate
- Breathing
- Balance
- Movement
- Swallowing
- Vertigo
- Nausea

Cognitive and Perceptual Dysfunction



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The value of dwelling on possible areas of cortical damage is controversial. The indication of specific areas of brain damage is an attempt to relate the study of neuroanatomy to actual patient behavior involving cognitive and perceptual dysfunction. Whether or not the area of the brain suggested to produce a particular dysfunction appears damaged on imaging or other neurological tests is ***NOT*** *a key determinant of the rehabilitative approach to therapy. The patient's approach to task performance and the relative strengths or weaknesses of the patient (motor, cognitive, and perceptual) are much more relevant to the selections of appropriate therapeutic strategies than the area of the brain injury. The following section includes specific treatment suggestions but the evidence base for these treatments is not strong and further research is required to support their effectiveness.*

ATTENTION DEFICITS

Clinical Examples: patient "drifts off" during an activity; patient has to stop dressing to talk to someone; easily disturbed by background noise; difficulty completing complex tasks such as cooking a meal or driving.

Lesion Areas: multiple sites including reticular formation, sensory system areas, limbic and frontal regions.

Treatment Suggestions: train patient to scan the visual environment in a slow and systematic manner; speak slowly to allow time to process verbal information; set time or speed limits; make important stimuli more noticeable; grade the environment from non-distracting to distracting.

MEMORY DEFICITS

Clinical Examples: patient unable to remember the instructions given only seconds before; may not be able to find way back to familiar areas; may not remember steps involved in transfers taught the day before; may not be able to hold a simple conversation.

Lesion Areas: multiple sites including cerebral cortex (frontal, parietal, temporal, occipital lobes) and limbic system.

Treatment Suggestions: encode information so it can be more easily retrieved including organizing material to be remembered and making logical associations; use of a diary or notebook system (memory log) or environmental prompts (beeper, alarm, wall calendar) can help many patients to manage their daily activities.

EXECUTIVE FUNCTION IMPAIRMENTS

Clinical Examples: patients may have problems determining what to do or how to organize their thoughts to carry out a task; difficulty weighing alternatives and making choices; unable to self-monitor or self-regulate behavior; may not be aware of their mistakes; display poor or unreliable judgment or inappropriate behavior; difficulty adapting to new situations; lack of attention to needs and feelings of others.

Lesion Areas: frontal and prefrontal cortex but mediated by other cortical and subcortical regions.

Treatment Suggestions: provide structure, feedback, and routine; give the patient steps to follow; use repeated practice; provide immediate feedback.

BODY SCHEME/IMAGE IMPAIRMENTS – Unilateral Neglect

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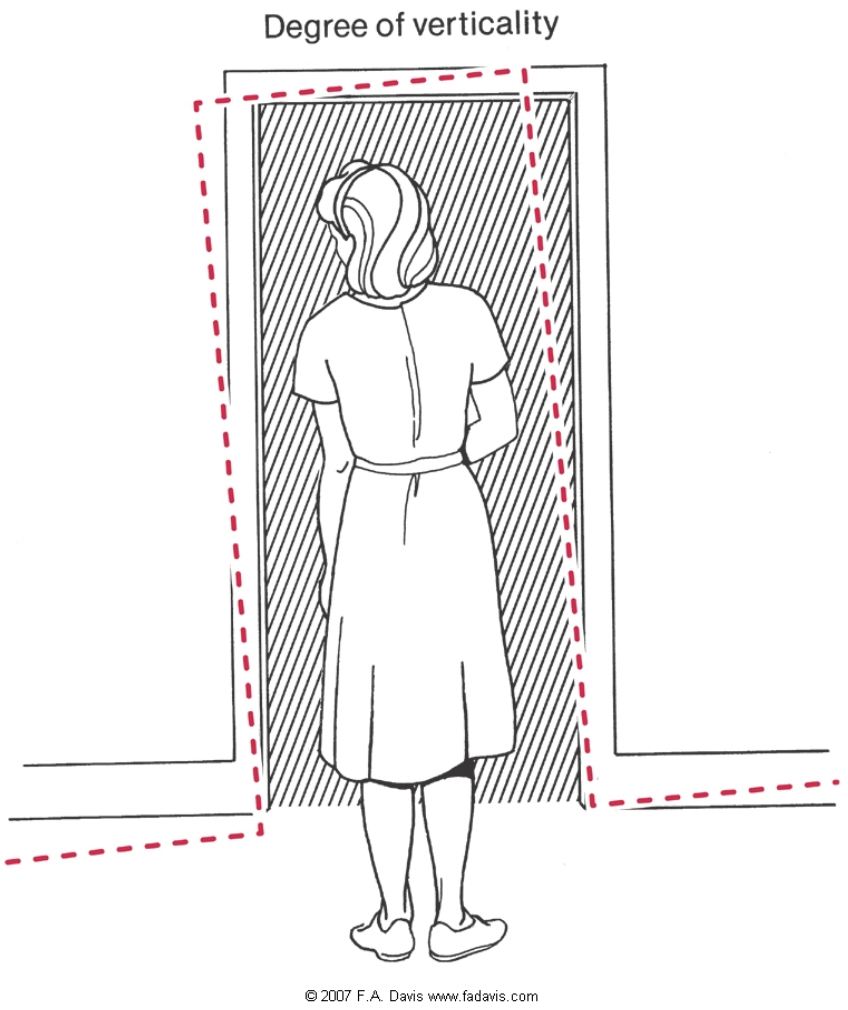
Clinical Examples: patient may ignore the left half of the body when dressing and forget to put on the left sleeve or pant leg; bumps into objects on the left side or tends to drift toward the right when walking or propelling a wheelchair; often avoids crossing the midline; usually affects the left side of the body and has sensory loss on the affected side but intact visual fields.

Lesion Areas: inferior-posterior regions of the right parietal lobe.

Treatment Suggestions: train patient to attend to the neglected side by using shapes and blocks (stimuli that are specialized for the right side of the brain) and minimize letters and numbers (stimuli that are specialized for the left side of the brain); minimize verbal instructions; use motor activities with left side of body such as clenching and unclenching a fist; cue for turning head to left to anchor gaze; eye-patching and prism glasses; colored margins on books or mirrors.

SPATIAL RELATION DISORDERS (COMPLEX PERCEPTION)



Clinical Examples: most frequent with right side lesions (left hemiparesis); inability to distinguish a figure from the background making it difficult to locate items in a drawer or button a shirt; confuse a pen with a toothbrush or cane with a crutch; difficulty learning to position arms, legs, and trunk in relation to the wheelchair for transferring; unable to path find; difficulty judging depth of stairs; vertical disorientation (see picture above).

Lesion Areas: right parietal lobe.

Treatment Suggestions: practice locating very different objects and progress to similar ones; practice describing and sorting like objects; give specific instructions and tasks that require crossing midline; practice going from place to place with instructions or key landmarks; use touch to reestablish a sense of depth/distance or for reorienting to vertical.

APRAXIA

Definition: inability to perform purposeful movements, which cannot be explained by neurological deficits (strength, coordination, sensation, tone, etc.). There is a disconnection between the idea of a movement and its motor execution. The patient is able to carry out habitual tasks automatically but unable to perform on command.

Clinical Examples: patient may fail to walk if requested to but if offered a cup of tea placed on a table at the other end of the room will likely walk to get it.

Lesion Areas: frontal/posterior parietal lobes (left/dominant hemisphere).

Treatment Suggestions: speak slowly and use the shortest possible sentences; one command given at a time and second command not given until first is completed; break tasks down into parts and teach one component at a time; when all units are mastered, attempt to combine them; a great deal of repetition may be necessary.

Possible Ways to Implement Intensity

- Use more realistic activities or meaningful tasks so that the patient can see the relevance.

- Choose tasks that are difficult for the patient
    - If they are succeeding 80-90%, it is too easy
    - If they are failing more than 50%, it is too difficult

- Have patients perform difficult activities multiple times during the day for their home program (complex tasks generalize to simpler tasks but simple tasks do not generalize to complex tasks.

- Avoid use of compensatory movements or skills.

- Upgrade tasks in therapy and home program frequently.

- Have the patient perform multiple repetitions of a few targeted tasks (repetition drives neural plasticity; animal research in the range of 400 reps).

- Have the patient perform the task faster.

- Consider changing the pattern of therapy appointments.

- Use motivational interviewing to engage patients in their work.

- Increase the amount of general activity your patient is participating in.

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Homework Assignment #3

Your Name: _____

Date assignment is completed: _____

Please choose one patient and use this form to gather information on that patient. Please do not include the patient's name. Please bring this form back with you next month and be prepared to discuss the case.

You will receive 2.0 CPD units for completion of this homework assignment.

S.M.A.R.T. GOAL WRITING AND DISCHARGE PLANNING

Write down three (3) short-term goals for this patient. Remember to make them SMART!

Describe one (1) long-term outcome you hope to achieve at discharge for this patient:

Write out when or why you will discharge this patient: