

The Patient with Neurological
Involvement and You:
Review and Update for the PTA

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Outline

- ▶ Quick review of various neurological disorders and their specific treatments
- ▶ Review of treatment strategies
- ▶ Discussion of new research
- ▶ Case studies

Cerebrovascular Accident

Left hemisphere injury

- ▶ Right side hemiplegia/paresis and hemisensory loss
- ▶ Speech-language impairments; communication is difficult
- ▶ Trouble planning/sequencing movement; apraxia
- ▶ Slow, cautious, anxious
- ▶ Realistic in self-assessment
- ▶ Can't do steps of task (breaking down into parts is difficult)
- ▶ Verbal cues are hard to process

Right hemisphere injury

- ▶ Left side hemiplegia/paresis and hemisensory loss
- ▶ Visual-perceptual deficits
- ▶ Quick & impulsive; safety is a concern
- ▶ Poor judgment; overestimates abilities
- ▶ Can't put it all together (putting the parts of a task together is difficult)
- ▶ Abstract concepts are difficult
- ▶ Visual cues are hard to process

Anterior Cerebral Artery CVA

- ▶ Contralateral sensory & motor loss (LE affected more than UE)
- ▶ Mental impairments (confusion, amnesia, etc.)
- ▶ Urinary incontinence
- ▶ Apraxia (deficits in motor planning)
- ▶ Slow, delayed movement
- ▶ Lack of spontaneous movement
- ▶ Behavioral changes

Middle Cerebral Artery CVA

- ▶ Contralateral sensory & motor loss, with face & UE affected more than LE
- ▶ Perceptual deficits
- ▶ Homonymous hemianopsia
- ▶ Aphasia
 - ▶ Broca's aphasia (expressive or motor aphasia)
 - ▶ Wernicke's aphasia (receptive or sensory aphasia)
 - ▶ Global aphasia

Posterior Cerebral Artery CVA

- ▶ Contralateral sensory & motor loss
- ▶ Homonymous hemianopsia
- ▶ Visual agnosia, prosopagnosia & cortical blindness
- ▶ Oculomotor nerve palsy
- ▶ **Thalamic pain syndrome:** spontaneous and debilitating pain and sensory perseveration
- ▶ **Pusher syndrome:** pushing toward the paretic side
- ▶ **Involuntary movements:** choreoathetosis, intention tremors and hemiballismus

Vertebrobasilar CVA

- ▶ Wide variety of symptoms, both ipsilateral & contralateral
- ▶ Cranial nerve involvement: diplopia, dysphagia, dysarthria, deafness and vertigo
- ▶ Ataxia
- ▶ **Locked-in Syndrome**
 - ▶ Cannot move or speak but is A&O with normal sensation
 - ▶ Utilize eye movements to communicate

Upper Extremity Synergy Patterns

	Flexion Synergy	Extension Synergy
Scapula	Retraction & elevation	Protraction
Shoulder	Abduction & ER	Adduction & IR
Elbow	Flexion	Extension
Forearm	Supination	Pronation
Wrist & Fingers	Flexion	Flexion

Lower Extremity Synergy Patterns

	Flexion Synergy	Extension Synergy
Hip	Flexion, abduction & ER	Extension & adduction
Knee	Flexion	Extension
Ankle	DF & inversion	PF & inversion
Toes	Extension	Flexion

Small Group Activity

- ▶ Identify four to five functional activities that could be aided by enlisting the concept of synergies (both UE and LE)

Traumatic Brain Injury

TBI Basics

- ▶ Know beginning and current Glasgow Coma Scale scores
 - ▶ ≤ 8 = coma
 - ▶ 9-12 = moderate impairment
 - ▶ 13-15 = mild impairment
- ▶ Watch for infection or signs of increased ICP based on type of injury (closed vs. open)

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Decreased Response Levels

- ▶ **Level I: No response**
 - ▶ Unresponsive to any stimuli
- ▶ **Level II: Generalized response**
 - ▶ Respond inconsistently and nonpurposefully
 - ▶ Responses may be physiological changes, gross body movements or vocalizations
- ▶ **Level III: Localized response**
 - ▶ Responses are related to the stimulus, but inconsistent
 - ▶ May follow simple commands but expect a delayed response

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Confused Levels

- ▶ **Level IV: Confused-agitated**
 - ▶ Behavior is nonpurposeful; very short attention span
 - ▶ Prone to verbal, emotional & physical outbursts
- ▶ **Level V: Confused-inappropriate**
 - ▶ Agitation is decreased, but patient is easily frustrated
 - ▶ Respond to simple commands fairly consistently but easily distracted
- ▶ **Level VI: Confused-appropriate**
 - ▶ Increased attention span
 - ▶ Able to perform goal-directed behavior with cueing

Appropriate Levels

- ▶ **Level VII: Automatic-appropriate**
 - ▶ Able to go through daily routine automatically but struggle with new tasks
 - ▶ Judgment continues to be impaired
- ▶ **Level VIII: Purposeful-appropriate**
 - ▶ Independent once activities are learned
 - ▶ May still have difficulty with reasoning and dealing with unusual circumstances
 - ▶ Social and emotional immaturity may continue

Basics of Decreased Response Levels

- ▶ **KEY POINT**
 - ▶ Review chart and daily nursing notes for complications, precautions and changes to patient's status.

Treatment in Decreased Response Levels

- ▶ Increase arousal & orientation through sensory stimulation (auditory, kinesthetic and tactile)
 - ▶ Explain all procedures to the patient, regardless of LOC
 - ▶ Utilize a memory or orientation book with schedules, personal information and pictures of people they will encounter
 - ▶ *KEY POINT: avoid overstimulation*

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Treatment in Decreased Response Levels

- ▶ Inhibition of tone, including approximation, rhythmic rotation, and prolonged stretch
- ▶ Prevent secondary complications by using PROM, stretching, proper positioning, getting patient to seated position, etc

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Treatment in Decreased Response Levels

- ▶ Positioning
 - ▶ Likely requires inhibition of tone first
 - ▶ Side-lying and semi-prone inhibit TLR
 - ▶ Slight ABD and ER of UE helps decrease tone
 - ▶ Always position out of decorticate or decerebrate posturing
 - ▶ Don't utilize soft objects—may push into them which increases tone
 - ▶ Prevent contractures, especially elbow flexors & ankle PF

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Treatment in Decreased Response Levels

- ▶ Develop postural control
 - ▶ Head and trunk control must be attained first
 - ▶ Use visual tracking or maintained visual contact
 - ▶ Prone and prone over wedge
 - ▶ Inhibits TLR and builds neck and trunk extensor strength
 - ▶ Prone over a therapy ball and rocking can help further reduce tone
- ▶ Complete activities hand-over-hand (HOH) to provide kinesthetic and proprioceptive feedback

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Treatment in Decreased Response Levels

- ▶ Sitting activities
 - ▶ Increase arousal and orientation
 - ▶ Decrease tone
 - ▶ Improve postural alignment
 - ▶ Begin to work on righting and equilibrium responses
 - ▶ Incorporate weight shifts
 - ▶ Move patient to ball or tilt board to increase challenge

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Treatment in Decreased Response Levels

- ▶ Transfers
- ▶ Standing activities
 - ▶ Allows weight bearing and increases sensory input
 - ▶ Can be combined with ADL and other functional tasks
 - ▶ May need tilt table if difficulty acclimating to upright position
- ▶ Educate family regarding PROM, sensory stimulation, positioning, etc

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Basics of Confused Agitated Level

▶ **KEY POINT**

- ▶ Safety of patient and those around him/her is an important consideration

- ▶ Patient can be very difficult to work with due to confusion and ensuing agitation
- ▶ Lacks attention and memory needed for motor learning

Treatment of Confused Agitated Level

▶ **Goals/ideas for treatment**

- ▶ Establishing a daily routine helps reduce confusion and, therefore, decrease agitation
- ▶ Help patient learn to control behavior by being calm & focused yourself
- ▶ Tell patient when inappropriate behaviors exist and reinforce positive behaviors
- ▶ Consider group treatment as peer modeling is often a positive assist

Treatment of Confused Agitated Level

▶ **Goals/ideas for treatment**

- ▶ Have multiple treatment activities in mind and allow patient some choice in selecting activities
- ▶ Keep the sensory stimuli in the environment to a minimum (low lighting, quiet, etc)
- ▶ Educate family regarding the patient's behavior

Basics of Confused Inappropriate and Confused Appropriate Levels

▶ **KEY POINT**

▶ Since motor learning is possible beginning at the Confused-Inappropriate level, treatment should begin to focus more on completion of functional skills.

▶ Patient is able to follow simple commands allowing a more thorough and accurate assessment

▶ Insight into disability is likely still limited

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Treatment of Confused Inappropriate and Appropriate Levels

▶ **Goals/ideas for treatment**

- ▶ Use a daily journal to facilitate memory and encourage communication with family
- ▶ Emphasize safety as the patient lacks good judgment and insight into limitations
- ▶ Teach family to assist with caregiver tasks in preparation for discharge

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Basics of Appropriate Levels

▶ **KEY POINT**

▶ Since return to independent living is likely a focus at this point, treatment must also focus on evaluating the patient's ability to safely perform functional tasks.

▶ Typically the patient will be in day therapy or outpatient therapy at this point

▶ Family should be familiar with resources available

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Treatment of Appropriate Levels

- ▶ Emphasize skills needed for independence
- ▶ Incorporate higher-level balance activities
 - ▶ Don't neglect protective and equilibrium reactions
- ▶ Cardiovascular conditioning
- ▶ Community outings
- ▶ Instruct patient in compensatory strategies as needed

Spinal Cord Injury

Level	Key Muscle(s)	Function
C1-3	Facial muscles	<ul style="list-style-type: none"> • Respirator for breathing • Electric W/C with sip & puff controls
C4	Diaphragm	<ul style="list-style-type: none"> • Independent respiration
C5	Deltoid Biceps Supinator	<ul style="list-style-type: none"> • Electric w/c with joystick • Transfers: overhead swivel bar & assist with sliding board transfers
C6	Latissimus Pectoralis major Wrist extensors Pronator teres	<ul style="list-style-type: none"> • Bed mobility: bed rails & overhead triangle • Transfers: independent with sliding board • Drive with hand controls • Tenodesis grip • Dressing with clothing adaptations • Manual W/C with projection hand rims
C7	Triceps Wrist flexors Finger extensors	<ul style="list-style-type: none"> • Transfers without sliding board • Able to get W/C in & out of car
C8- T1	Intrinsic hand muscles **Full UE innervation**	<ul style="list-style-type: none"> • W/C with standard rims • Strong grip & fine motor control

Level	Key Muscles	Function
T4-6	Intercostals Upper back muscles	<ul style="list-style-type: none"> Improved trunk control & respiration Participation in W/C sports Use of "wheelie" for curbs Stand with bilateral HKAFO with spinal attachment
T9-12	Abdominals	<ul style="list-style-type: none"> Household ambulation with bilateral HKAFO and crutches or walker
L2-4	Some quads Hip flexors Hip adductors	<ul style="list-style-type: none"> Functional ambulation with bilateral KAFO and crutches
L4-5	Some hamstrings Tibialis anterior	<ul style="list-style-type: none"> Ambulation with bilateral AFO

Respiratory Management

- ▶ Diaphragmatic breathing
- ▶ Lateral expansions and chest wall stretching
- ▶ Diaphragm strengthening exercises including incentive spirometry
- ▶ Assisted coughing
- ▶ Postural drainage
- ▶ Abdominal support may be needed

ROM Requirements

- ▶ *Upper Extremities*
 - ▶ Greater than normal extension and ER
 - ▶ Full elbow and wrist extension and forearm supination
 - ▶ Mild shortness in the long finger flexors if using tenodesis grip

ROM Requirements

- ▶ *Trunk and Lower Extremities*
- ▶ Mild shortness in the low back
- ▶ Straight leg raise of 110-120°
- ▶ Hip extension to neutral if non-ambulatory; full hip extension if ambulatory
- ▶ Ankle DF to neutral if not standing; full DF for standing stability and ambulation

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Positioning

- ▶ Prevention of decubitus ulcers
 - ▶ Bedridden patients: repositioned every 2hrs
 - ▶ Patients in a wheelchair: weight shift every 15-30min
- ▶ Inspect skin over bony prominences
 - ▶ Redness that doesn't disappear within 20min is a concern
- ▶ Helps prevent contractures, especially hip flexors, hamstrings & elbow flexors

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Treatment

- ▶ Increase tolerance to upright positions
- ▶ Tenodesis grip (used by patients with C6 lesion)
 - ▶ *KEY POINT:* Position to let finger flexors shorten (fingers flexed when in a position of wrist extension)

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Spasticity Management

- ▶ Medical management
 - ▶ Baclofen
 - ▶ If given orally, may cause overall body hypotonia
 - ▶ Intrathecal administration is more localized
 - ▶ Botox
 - ▶ During effects, intense stretching and antagonist strengthening should occur
 - ▶ Tenotomy
 - ▶ Rhizotomy/Selective Dorsal Rhizotomy

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Spasticity Management

- ▶ PT
 - ▶ Positioning
 - ▶ Static stretching
 - ▶ Weightbearing
 - ▶ Cryotherapy
 - ▶ Aquatherapy
 - ▶ Functional electrical stimulation
 - ▶ AFO and serial casting

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Multiple Sclerosis

Multiple Sclerosis Key Points

- ▶ Aggravating factors
 - ▶ Pregnancy
 - ▶ Trauma
 - ▶ Infection
 - ▶ Stress
- ▶ Avoid
 - ▶ Heat
 - ▶ Hyperventilation
 - ▶ Dehydration
 - ▶ Fatigue

Frenkel Exercises

- ▶ Coordination exercises performed in half-lying, sitting, standing and walking
- ▶ Developed primarily for the LE but concepts can be applied to develop UE exercises
- ▶ Progress from assisted → independent and from unilateral to bilateral

Vestibular Dysfunction

Benign Paroxysmal Positional Vertigo (BPPV)

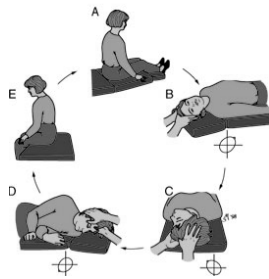
▶ Signs and symptoms

- ▶ Rapid head movements cause vertigo & nystagmus
- ▶ Functional limitations: getting into/out of bed, turning in bed, bending over to pick something up or reaching upward to get something on a high shelf

Benign Paroxysmal Positional Vertigo (BPPV)

▶ Treatment

- ▶ Epley maneuver/Canalith repositioning maneuver
- ▶ Habituation techniques



Coordination Dysfunction

Coordination

- ▶ Can arise with age or injury to one of three areas:
 - ▶ Cerebellum
 - ▶ Basal ganglia
 - ▶ Proprioceptive system supplying information to the CNS

*Coordination Impairments 2°
Cerebellar Dysfunction*

General difficulty performing the movement as intended

- ▶ Dysdiadochokinesia
- ▶ Dysmetria
- ▶ Movement decomposition
- ▶ Intention tremors
- ▶ Postural tremors
- ▶ Gait disorders
- ▶ Asthenia
- ▶ Rebound phenomenon

*Coordination Impairments 2°
Basal Ganglia Dysfunction*

Typically movements that are not desired

- ▶ Rigidity
- ▶ Resting tremor
- ▶ Bradykinesia
- ▶ Akinesia
- ▶ Dystonia
- ▶ Hemiballismus
- ▶ Chorea
- ▶ Athetosis

Treatment Review

Reflexes

- ▶ Reflexes are controlled by various levels of the CNS
 - ▶ *Cortex*: equilibrium reactions
 - ▶ *Midbrain*: righting/protective reactions
 - ▶ *Brainstem*: postural/tonic reactions
 - ▶ *Spinal cord*: primitive reflexes
- ▶ When adults have CNS damage, these reflexes can return and effect movement

Constraint-induced movement therapy (CIMT)

- ▶ Sometimes referred to as “forced use”,
- ▶ Beneficial in the subacute & chronic stages of recovery to increase use of the more impaired UE
- ▶ Considers itself a “substitution approach”, as it retrains the UE to be used but in a different manner than before the injury
- ▶ Commonly referred to as a “treatment package” involving:
 - ▶ Repetitive, task-oriented training
 - ▶ Transfer Package to increase transfer to life situations
 - ▶ Imploring patient to use the more involved extremity during waking hours

Motor Control

Motor Control Basics

- ▶ Involves the interaction between the individual, task and environment
 - ▶ *Individual*: attention, motivation, strength, ROM, balance, cognition
 - ▶ *Task*: characteristics and demands of the task
 - ▶ *Environment*: lighting, noise, variability

Characteristics of the Task

- ▶ **Mobility**: ability to move from one position to another
 - ▶ Often random, reflex based movements
 - ▶ Distal mobility
 - ▶ Ex: rolling into sidelying, sit→stand, transfers
 - ▶ Deficits: failure to initiate or sustain movement, poorly controlled movements

Characteristics of the Task

- ▶ **Stability:** maintain COM over the BOS with the body not in motion
 - ▶ Static postural control
 - ▶ Proximal stability
 - ▶ Ex: prone on elbows, quadruped, kneeling, standing, ½ kneeling
 - ▶ Deficits: widened BOS, lowered COM, increased postural sway, HHA, LOB, falls

Characteristics of the Task

- ▶ **Controlled mobility:** maintaining stability and COM or the BOS when body parts are in motion
 - ▶ Dynamic postural control
 - ▶ Proximal mobility with distal stability
 - ▶ Ex: closed chain activities, weight shifting, lifting, reaching, stepping
 - ▶ Deficits: postural instability, LOB, falls, limited dynamic limb movements

Characteristics of the Task

- ▶ **Skill:** well coordinated movements in sequence to manipulate and explore the environment
 - ▶ Mobility imposed on already developed stability
 - ▶ Proximal stability with distal mobility
 - ▶ Ex: walking, reaching and manipulation
 - ▶ Deficits: poorly coordinated movements, movement decomposition, fixation deficits, poor postural stability, slowed movement or reaction times

Task Analysis for Skill Completion

- ▶ Understanding the task
 - ▶ What are the individual components of the movement?
 - ▶ How is the activity initiated, executed and terminated?
 - ▶ What motor control strategies are required?
 - ▶ Mobility, stability, controlled mobility

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Task Analysis for Skill Completion

- ▶ Understanding the individual
 - ▶ What impairments are present?
 - ▶ Do impairments affect quality of movement?
 - ▶ Can the skill be completed?
 - ▶ What components of movement are normal? abnormal?
 - ▶ What is patient's current ability to complete the skill?
 - ▶ What compensatory movements are utilized?

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Task Analysis for Skill Completion

- ▶ Understanding the environment
 - ▶ What components of the environment are likely to affect skill completion?
 - ▶ Can the environment be altered in order to increase or decrease the demands?

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Small Group Activity

- ▶ Select a skill from the following list and complete a task analysis of the skill
 - ▶ Bed mobility
 - ▶ Creeping
 - ▶ Sitting
 - ▶ Sit ← → Stand
 - ▶ Kneel → Half kneel
 - ▶ Half kneel → Stand
 - ▶ Standing
 - ▶ Walking
 - ▶ Ascending/descending stairs

Motor Learning

Motor Learning Stages

- ▶ Cognitive stage
 - ▶ Understanding what to do; task mastery is **not** the goal
 - ▶ Cognition and sensory input are key in this stage, therefore it is a difficult stage for individuals with cognitive or sensory deficits

Motor Learning Stages

- ▶ Associative stage
 - ▶ Concentration is on how to do the task
 - ▶ Sensory feedback is essential in this stage
 - ▶ Practice and error detection lead to success
 - ▶ During this stage, people are easily frustrated; sensory or motor deficits may increase the frustration

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Motor Learning Stages

- ▶ Autonomous stage
 - ▶ Task mastery has occurred; cognitive demand is decreased
 - ▶ Change at this stage is slow because of decreased attention to the task and its details

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What should the PTA do?

- ▶ Cognitive Stage
 - ▶ Provide clear & simple verbal instructions and visual feedback
 - ▶ Reinforce proper performance and correct only consistent errors and safety issues
 - ▶ Actively engage the patient in self-monitoring and self-correction
 - ▶ Manual guidance may be used as needed

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What should the PTA do?

- ▶ Associative & Autonomous Stages
 - ▶ Focus the patient's attention on proprioceptive feedback (intrinsic feedback)
 - ▶ Avoid hands-on techniques
 - ▶ Introduce environmental distractions & modifications

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Regarding Feedback

- ▶ Early in rehabilitation feedback is provided more frequently and decreased as learning occurs
- ▶ Identify your goal: do you want performance of the skill or long-term retention?
 - ▶ While continuous feedback will likely increase current skill performance, it may be detrimental to learning the task for long term use

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Small Group Activity

Using the same task

- ▶ Identify three activities you could use during the cognitive stage of motor learning
 - ▶ How would you provide feedback about the patient's performance at this stage?
- ▶ Identify three activities that would be advancements of your initial activities for a patient in the associative or autonomous stage
 - ▶ How would you provide feedback about the patient's performance at this stage?

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Perceptual Dysfunction and Treatment

Anosognosia

Denial or lack of awareness of one's paralysis

Assessment	Effects on Function	Treatment and/or Management Strategies
Talk with patient about what happened, if they are paralyzed, why they can't move the extremity	Difficult to get patient to use affected limb during rehab, safety concerns	Usually resolves spontaneously, tactile stimulation to affected limb, visual attention drawn to limb

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Unilateral Neglect

Unable to perceive stimuli from one half of the body (body neglect) or the environment (spatial neglect)

Assessment	Effects on Function	Treatment and/or Management Strategies
Observation during completion of functional skills, have patient copy drawings, place objects on left side	Dressing one side of body, shaving one side of face, put makeup on one side of face, bump into objects on left side	Stimulate the right side of the brain (shapes/blocks), encourage looking to left, use left UE and LE to complete activities, place ribbon on affected extremity, mirror, draw lines of papers

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Somatoagnosia (aka body agnosia)

Impairment of body scheme that may be due to lack of proprioception

Assessment	Effects on Function	Treatment and/or Management Strategies
Point to body parts named, imitate PTA movements, discuss relationship of body parts, DO NOT use terms right and left	Difficulty with transfers, completing exercises	Sensory stimulation of named body parts, visual reminders of parts needed to complete activities (ribbon on R arm to complete R exercises)



Right-Left Discrimination Disorder

Assessment	Effects on Function	Treatment and/or Management Strategies
Point to body parts named, first without use of R and L to rule out somatoagnosia	Dressing is difficult, following directions, topographical disorientation	Visual markers on right shoe or hand, point out rings and watches worn on a certain hand and use these as commands rather than right and left ("hand with wedding ring")



Topographic Disorientation

Inability to remember how to get from point A to point B

Assessment	Effects on Function	Treatment and/or Management Strategies
Have patient describe or draw a familiar route or room outline	Unable to get from one place to another or describe spatial relationships of familiar locations	Practice routes, take easiest routes, mark with visual cues, remind patient not to leave home/clinic without assistance (usually recovers within 8 wks)



Depth & Distance Perception

Assessment	Effects on Function	Treatment and/or Management Strategies
Patient asked to grasp object held in mid-air (will overshoot target) or fill glass with water	Trouble with stairs, sitting in chair, pouring liquids, dumping objects	Discuss safety issues, use intact senses, retrain sense of depth perception

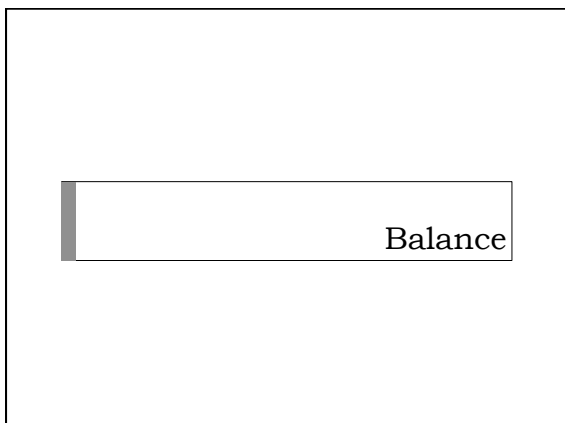
Apraxia

- ▶ Inability to perform purposeful, skilled movement despite intact strength, coordination, sensation, attention & comprehension
- ▶ Treatment/Management Strategies
 - ▶ Give single-step directions, breakdown tasks, incorporate multiple sensory systems
 - ▶ Demonstrate putting pieces together, draw diagrams of how to construct objects, use verbal cues

Small Group Activity

Using the same task from the first two activities

- ▶ Identify how you would modify each of your activities for a patient with a perceptual disorder (your choice)



Functional balance grades: STATIC

- ▶ *Normal:* maintain balance without hand hold support
- ▶ *Good:* maintain balance without hand hold support, demonstrating limited postural sway
- ▶ *Fair:* maintain balance with hand hold support and occasional minimal assistance
- ▶ *Poor:* requires hand hold support and mod→max assistance to maintain balance

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Functional balance grades: DYNAMIC

- ▶ *Normal:* accepts maximal challenge and easily weight shifts in all directions throughout the full range
- ▶ *Good:* accepts moderate challenge (pick up item off floor without losing balance)
- ▶ *Fair:* accepts minimal challenge (maintain balance while turning head or body)
- ▶ *Poor:* unable to accept challenge or move without LOB

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Balance Assessments

Static standing balance	Dynamic standing balance	Outcome measurement tests
Romberg/Sharpened Romberg	Functional reach	GUG/T-GUG
Unilateral stance	Multi-directional reach	Tinetti
Timed standing	Functional walking tests	Berg
Nudge-push test	Stooping to pick up items	
Turning, stopping, starting		

General treatment considerations

- ▶ Ensure appropriate posture prior to working on balance exercises
- ▶ Keep the exercises similar to functional activities the patient will be performing
- ▶ Include recreational activities (golf, tennis, etc) to increase patient motivation and compliance
- ▶ Consider all environments the patient will be encountering, including various surfaces for ambulation (carpet, tile, etc)

Balance Safety Considerations

- ▶ Always use a gait belt
- ▶ Perform exercises in parallel bars or near a railing
- ▶ Make sure the floor is clean, dry and free of debris
- ▶ Place shoes or non-skid socks on the patient's feet
- ▶ Consider standing in front of a mat if playing catch and no one is guarding them
- ▶ When working with high risk patients, have one person in front and one person behind the patient

Balance Exercises
For individuals with low functioning levels

- ▶ Upper extremity (sitting in chair)
 - ▶ Bicep curls
 - ▶ Basic bench press
 - ▶ Basic military press
 - ▶ Shoulder shrugs
 - ▶ Shoulder rolls, forward and back
 - ▶ Forward, lateral and backward lean

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Balance Exercises
For individuals with low functioning levels

- ▶ Lower extremity (sitting in chair)
 - ▶ LAQ
 - ▶ Heel and toe raises
 - ▶ Marching
 - ▶ Abductions
 - ▶ Heel slides

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Balance Exercises
For individuals with low functioning levels

- ▶ Standing exercises (at parallel bars)
 - ▶ Weight shifts
 - ▶ Heel and toe raises
 - ▶ Marching
 - ▶ Hamstring curls
 - ▶ Mini-squats

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Balance Exercises
For individuals with low functioning levels

- ▶ Standing exercises (at parallel bars)
 - ▶ Multi-directional hip motions (V, ABD-ADD, I)
 - ▶ Mini-lunges on the clock
 - ▶ Unilateral and tandem stance
 - ▶ Ladders in parallel bars
 - ▶ Stair training (may be too difficult for some)

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Balance Exercises
For individuals with higher functioning levels

- ▶ Walking exercises
 - ▶ Vary speed and stride length
 - ▶ Tandem walking
 - ▶ Grapevine
 - ▶ Side stepping
 - ▶ Stepping up low rises and over obstacles

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Balance Exercises
For individuals with higher functioning levels

- ▶ Perturbation training
 - ▶ Reactive postural control: therapist provided nudge to patient
 - ▶ Anticipatory postural control: patient pushing therapist
 - ▶ As patient becomes more balanced, provide perturbations with walking activities

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Balance Exercises
For individuals with higher functioning levels

- ▶ Additional exercises
 - ▶ Sit to stand practice
 - ▶ Turning around
 - ▶ Getting up from the floor
 - ▶ Stooping to pick up objects from the floor
 - ▶ Obstacle course

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Balance Exercises
For individuals with higher functioning levels

- ▶ Challenge for all exercises above can be increased by:
 - ▶ Altering the support surface (grass, carpet, foam, therapy ball, etc)
 - ▶ Increasing perturbations
 - ▶ Decreasing BOS
 - ▶ Incorporating UE activities
 - ▶ Closing eyes
 - ▶ Adding resistance (T-band, weights, etc)
 - ▶ Requiring a cognitive task simultaneously

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Small Group Activity

- ▶ Identify three balance activities using each of the following pieces of equipment:
 - ▶ Foam square
 - ▶ Mirror
 - ▶ BAPS board
 - ▶ Swiss ball
 - ▶ Foam roller
 - ▶ Trampoline

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Neurodevelopmental Treatment (NDT)

NDT Overview

- ▶ Developed when working with children with CP
- ▶ Focus is on balance and normal movement sequences
 - ▶ Functional, goal-oriented activities
 - ▶ Use of involved body segments
 - ▶ Isolated, out-of-synergy movements are promoted
 - ▶ Sensory facilitation or inhibition is used to normalize tone
- ▶ **KEY POINT**
 - ▶ Substitution/compensation is **NOT** permitted

Principles of NDT

- ▶ **Handling**
 - ▶ Most important part of the NDT approach
 - ▶ Hands are used to support and assist movement
 - ▶ *Key points of control*
 - ▶ Proximal: shoulders and pelvis
 - ▶ Distal: head, hands and feet
- ▶ **Positioning**
 - ▶ Aids with preventing deformity
 - ▶ Provides stability for independent movement

Principles of NDT

- ▶ Use of Adaptive Equipment
 - ▶ Helps control instability, provide postural support, prevent deformity, and enhance function

- ▶ Use of Sensory Input
 - ▶ Aid with voluntary movement control and improve quality of movement
 - ▶ Weight bearing, tapping, stretching, manual touch, visual & verbal feedback, etc.

Proprioceptive Neuromuscular Facilitation (PNF)

PNF Overview

- ▶ Developed with the goal of treating paralysis
- ▶ Based on the philosophy that normal movement patterns are spiral and diagonal
- ▶ Promotes normal neuromuscular function by stimulating proprioceptors

- ▶ **KEY POINT**
 - ▶ Muscles can be strengthened by working within synergies

Importance of Feedback

- ▶ Resistance and stretch are used to stimulate proprioceptors and strengthen muscles
- ▶ Extrinsic feedback is given through verbal cues and PTA hand placement
- ▶ Intrinsic feedback is received from vision as patient is encouraged to follow movements with their eyes

UE Diagonal Patterns

Pattern	Shoulder motions	Verbal Cue
D1F	Flexion-adduction-ER	Close your hand, turn, and pull your arm up across your face.
D1E	Extension-abduction-IR	Open you hand, turn, and push your arm down and out.
D2F	Flexion-abduction-ER	Open your hand, turn, and lift your arm up and out.
D2E	Extension-adduction-IR	Close your hand, turn, and pull your arm down and across your body.

LE Diagonal Patterns

Pattern	Hip motions	Verbal Cue
D1F	Flexion-adduction-ER	Bring your foot up, turn, and pull your leg up and across your body.
D1E	Extension-abduction-IR	Push your foot down, turn, and push your leg down and out.
D2F	Flexion-abduction-IR	Lift your foot up, turn, and lift your leg up and out.
D2E	Extension-adduction-ER	Push your foot down, turn, and pull your leg down and in.

Head and Trunk Patterns

- ▶ Chop *Lead arm = free hand*
 - ▶ Lead arm moves into D1 Extension
 - ▶ Head and trunk flex and rotate right or left

- ▶ Lift
 - ▶ Lead arm moves into D2 Flexion
 - ▶ Head and trunk extend and rotate right or left

▶

PNF Treatment Techniques

- ▶ Combination of Isotonics (Agonist Reversals)
 - ▶ *Frequent uses:* facilitating controlled mobility, increasing muscle strength and endurance, facilitating coordination, improving control of eccentric contractions, facilitating postural muscles
 - ▶ *Example of use:* bridging

▶

PNF Treatment Techniques

- ▶ Stabilizing Reversals (Alternating Isometrics)
 - ▶ *Frequent uses:* promote stability, strength and endurance in developmental positions and proximal extremity joints
 - ▶ *Example of use:* increasing trunk stability

▶

PNF Treatment Techniques

- ▶ Contract Relax
 - ▶ *Frequent uses:* increasing passive joint range in shortened two-joint muscles
 - ▶ *Example of use:* increasing multi-planer shoulder ROM

▶

PNF Treatment Techniques

- ▶ Hold Relax
 - ▶ *Frequent uses:* increase passive joint mobility, decreasing pain related to movement
 - ▶ *Example of use:* SLR (increasing hamstring length)

- ▶ *Can utilize Hold Relax Active Movement where patient moves in to new range. *Only used when pain is present so patient can prevent injury by not overstretching.*

▶

PNF Treatment Techniques

- ▶ Resisted Progression
 - ▶ *Frequent uses:* improving coordination with movement, increasing endurance
 - ▶ *Example of use:* ambulation with resistance band

▶

PNF Treatment Techniques

- ▶ Rhythmic Initiation
 - ▶ *Frequent uses:* teaching new skills, facilitating initiation of movement, coordination of movement, relaxation
 - ▶ *Example of use:* rolling, sit→stand

▶

PNF Treatment Techniques

- ▶ Rhythmic Rotation
 - ▶ *Frequent uses:* decrease spasticity to increase mobility, promoting full body relaxation
 - ▶ *Example of use:* lower trunk rotation in hook lying

▶

PNF Treatment Techniques

- ▶ Rhythmic Stabilization (p. 258)
 - ▶ *Frequent uses:* promote joint stability, maintaining a desired developmental position, improve coordination
 - ▶ *Example of use:* increasing trunk stability with unsupported sitting

▶

PNF Treatment Techniques

- ▶ Dynamic Reversals (Slow Reversals)
 - ▶ *Frequent uses:* increase strength, improve ROM, develop coordination, increase endurance
 - ▶ *Example of use:* moving between PNF diagonal patterns

▶

PNF Treatment Techniques

- ▶ Dynamic Reversal Hold (Slow Reversal Hold)
 - ▶ *Frequent uses:* facilitates transition from mobility to stability stage, increases strength, balance and endurance
 - ▶ *Example of use:* moving through D2 Flexion and D2 Extension with a resisted isometric at the end of each motion

▶

Small Group Activity

Using the same task

- ▶ Identify how you could use NDT key points of control for your skill
- ▶ Utilize PNF strategies to enhance the treatment
 - ▶ Identify two diagonal and/or head/trunk patterns
 - ▶ Select three additional PNF strategies

▶

Other Treatment Strategies

Sensory Stimulation Techniques

- ▶ Things to remember about this approach
 - ▶ Can facilitate or inhibit the motor response
 - ▶ Hands-on stimulation should not be used after the initial stages of motor learning as excessive stimulation can impair voluntary control of movement
 - ▶ Avoid sensory overload: can cause the CNS to shut down or stimulate a sympathetic response in which the patient becomes agitated

Sensory Stimulation Techniques

- ▶ Quick Stretch
 - ▶ Brief stretch applied to a muscle
 - ▶ Facilitates agonist and synergists, inhibits antagonists
 - ▶ More effective when muscle is in a lengthened range (tapping over a muscle belly or tendon)
 - ▶ *Caution:* may increase spasticity in spastic muscles

Sensory Simulation Techniques

- ▶ Prolonged Stretch
 - ▶ Slow, maintained stretch at end range
 - ▶ Inhibits muscle contraction and tone
 - ▶ May be more effective in extensor muscles than flexors
 - ▶ Activating the antagonist following stretch can prolong the inhibition

▶

Sensory Simulation Techniques

- ▶ Resistance
 - ▶ Resisting a muscle contraction, either through external force or body weight and gravity
 - ▶ Facilitates agonist and synergists, inhibits antagonists
 - ▶ May see carryover to weak muscles in the same synergy or contralateral extremities
 - ▶ *Caution:* substitution may occur if too much resistance is applied to weak or hypotonic muscles; may increase spasticity in spastic muscles

▶

Sensory Simulation Techniques

- ▶ Joint Approximation
 - ▶ Compression of joint surfaces
 - ▶ Facilitates co-contraction and proprioception
 - ▶ Often applied in upright, weightbearing positions to improve stability via facilitation of postural extensors
 - ▶ *Caution:* not to be used with inflamed, painful joints

▶

Sensory Simulation Techniques

- ▶ Joint Traction
 - ▶ Distraction of joint surfaces
 - ▶ Facilitates joint motion and proprioception; may decrease muscle spasm or pain
 - ▶ *Caution:* not used in joints that are hypermobile or unstable

▶

Sensory Simulation Techniques

- ▶ Inhibitory Pressure
 - ▶ Either deep, maintained pressure at the tendon or prolonged positioning in end range
 - ▶ Inhibition of muscle tone
 - ▶ Extensor tone is decreased with prolonged kneeling
 - ▶ Flexor tone is inhibited with prolonged WB on extended arm, wrist, and fingers
 - ▶ PF tone is dampened by pressure over the Achilles tendon
 - ▶ *Caution:* prolonged position may decrease muscle performance to the point of affecting functional performance

▶

Sensory Simulation Techniques

- ▶ Vestibular stimulation
 - ▶ Either fast or slow movements that stimulate the vestibular apparatus
 - ▶ Fast stimulation facilitates tone and muscle contraction; slow stimulation is inhibitory

▶

Compensatory Training Approach

- ▶ Patient uses current abilities to regain functional independence
- ▶ Things to remember
 - ▶ Task simplification & environmental adaptations are the key components
 - ▶ Concerns with this approach
 - ▶ Learned nonuse may suppress recovery if used too early
 - ▶ Development of “splinter skills”

Task-Oriented Approach

- ▶ Rehab focuses on functional tasks rather than individual muscles or movements
- ▶ Therapist provides feedback while manipulating task and environment to promote motor learning
- ▶ Patients are encouraged to actively problem-solve and experiment with different movement strategies during the learning process
- ▶ **KEY POINT**
 - ▶ Tasks must be important to the patient (goal-oriented)

Small Group Activity

Using the same task

- ▶ Select two sensory stimulation techniques to incorporate in your treatment
- ▶ Identify two compensations that may be used to complete the skill
- ▶ Select two “real-life” tasks you could associate this with to encourage the patient’s completion of the skill

Research

What are we talking about right now?

- ▶ Use of ICF as a model for rehab
- ▶ Constraint-induced therapy
- ▶ Body-weight supported treadmill training
- ▶ Balance and predictability of falls
- ▶ Importance of cardiovascular training following neurological insult
- ▶ Use of motor control and motor learning theories

Case Study

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