Beyond the Straight Leg Raise

Neuro for the Non-Neuro Therapist

A Review and Discussion of Neurological Physical Therapy Assessment and Interventions to Maximize Client Outcomes
Objectives

• Define neurological treatment terminology.
• Identify core concepts of each neurological PT approach.
• Discuss the role of motor control and motor development as pertain to each approach.
• Identify methods of assessment critical to each approach.
• Describe the physiologic and clinical rationale as well as methods for using specific treatment techniques.
• List and describe aspects of movement dysfunction common to patients with Central Nervous System dysfunction.
• Utilize a systematic approach to clinical decision-making including selection assessment methods, development of functional goals, and formation of plan of care.
• Discuss the benefits and limitations of each treatment approach.
Objectives (cont’d)

- Demonstrate basic postural and mobility assessment and handling skills including modifications based on client response as needed for skilled facilitation/inhibition techniques and methods of enhancing movement.
- Utilize the principles of neuroplasticity through physical therapy interventions.
- Discuss differences in “strengthening” in musculoskeletal and neurological conditions.
- Identify treatment techniques and specific interventions that can be applied clinically to maximize treatment sessions.
- Discuss deviations specific to neurologic gait including possible causes and treatments.
- Discuss when to compensate and when to normalize movement following central nervous system pathology, with primary focus on CVA and BI.
Case Scenario – What would you do?

• List:
  – Impairments
  – Functional Limitations

  – 5 Treatment ideas
Who May Benefit From Neuro-rehab?

Individuals with:

- Stroke (most common diagnosis)  
  (Richards et al, 2005; Trombly & Ma, 2002)
- Brain Injury
- Multiple Sclerosis
- CNS Tumors
- Myopathies
- Neuromuscular diseases
- Encephalopathies  
  (Jorger et al, 2001)
Potential Benefits

Individuals with both acute and chronic neurological conditions have shown benefit from neuro-rehab

- Gain for those with chronic disabilities less overall, but still significant

- Those under 30 y/o tend to demonstrate more improvement, but beyond that age is not statistically relevant

- Measure used: Extended Barthel Index
  - (Jorger, et al 2001)
The Challenge of Obtaining Evidence

Very few of our “traditional” treatments in neuro-rehab are backed by sound evidence

Multiple factors confound rehab research:
- Lack of research experience
- Lack of support for clinicians to do research
- Multidisciplinary treatment confounds tx effects
- Individually determined treatment goals (client-centered practice!)
- Presence of co-morbidities
More Factors that Make Neuro-rehab Research Difficult

- Spontaneous recovery
- Demographic variables (age, premorbid fitness level, etc.)
- Etiology and location of injury
- Heterogeneity of type and severity of deficits
- Individualized nature of interventions
  (NDT, facilitation, key points of control)
- Associated neurological problems
  (language, visual concerns, cognitive deficits, etc.)

  Good, 2003
Role of PT in Neuro-rehab  
(in order of frequency, with clients after CVA)

Remediation of body structure and function impairments

– LE motor control, postural control
– Mobility: transfers, walking, bed mobility, stairs

Education in compensatory/adaptive strategies for functional task performance

• Richards et al, 2005; Latham et al, 2006

Client and caregiver education
Basic Brain Neuro Anatomy
Damage to specific areas of the brain

Cerebellar Lobe Damage
- Coordination
- Balance
- Vestibular issues

Frontal Lobe Damage
- Apathy/indifference
- Spoken language
- Poor problem solving
- Memory loss
- Personality changes
- Antisocial behavior
- Disinhibition
- Motor impairments

Occipital Lobe Damage
- Visual cortex

Temporal Lobe Damage
- Comprehension of language
- Auditory issues
- Learning and memory

Limbic Lobe Damage
- Emotional impairments
- Recognizing danger
- Expression of emotions
- Memory

Parietal Lobe Damage
- Sensation
- Language comprehension
- Hemi-neglect, esp. w/ R damage
- Perceptual deficits
Neuro Anatomy Impairments

Right Brain
- Neglect/Hemi-inattention
- Impulsivity
- Impaired judgement and decision making
- Impaired attention
- Spatial perceptual deficits

Shared
- Visual field deficits
- Contralateral hemiparesis hemiplegia
- Coordination
- Balance/Vestibular

Left Brain
- Inattention rare
- Speech issues
- Aphasia
- Decreased initiation
- Apraxia
- Difficulty learning new information and conceptualizing
Basic Brain Neuro Anatomy

• Redundancy
  – Our brain has overlapping areas of function

• Injuries do not usually isolate to one area
  – Hemorrhagic/Hematoma – bleed can be carried to other tissue areas
  – Ischemic/Anoxic – amount of time blood supply restricted may affect other parts of the brain
Neuroplasticity

• Habituation – decreased response to a repeated, benign stimulus
  – Gradually increase the intensity of the stimulation
  – Can be short-term

• Learning and memory
  – With repetitions, learn to focalize brain, promotes new synaptic connections, astrocytes change in response to changes in stimulation patterns

adapted from Neuroscience: Fundamentals for Rehabilitation
Neuroplasticity

- Reorganization of the cerebral cortex
  - Modified by sensory input, experience, and learning; regular performance of skilled motor task

- Activity-related changes in neurotransmitter release
  - Increased stimulation can increase inhibitory neurotransmitters and decrease sensitive to overstimulation, vice versa is true

**Neuroplasticity requires task experience, attention, and motivation**

adapted from Neuroscience: Fundamentals for Rehabilitation
Kleim’s Principles of Neuroplasticity

- Use it or lose it
- Use it and improve it
- Specificity
- Repetition
- Intensity
- Time
- Salience
- Age
- Transference
- Interference

(Kleim & Jones, 2008)
PT Role -- your thoughts

• What is Neuro PT?
• What is BEST Neuro PT?
• How are neuro patients challenging?
PT Role

- Identify impairments and resulting functional limitations

- Approach to treatment
  - Impairment-based
  - Function-based
  - Treatment-approaches
  - Combination
PT Role

- Know the principles & criteria of neuroplasticity and apply them to treatment
  - Reps
  - Environment
  - Etc.

- Stimulate the neurological system
  - Proper alignment
  - Use of functional positions

- Buy-in from the patient/ caregiver
Evaluation

Where is the abnormal movement coming from?

- Do they have the capacity for normal movement?
- Weight bearing
- Pelvis/Core/Trunk
- Balance
- Alignment/posture – static and with transitional movements
- ROM
  - Especially trunk, hip extension and dorsiflexion
- MMT
  - Especially trunk, hip extension and abduction, and ankle DF/PF for gait and balance
  - Substitutions
  - Muscle imbalances
  - Motor recruitment strategies
  - Synergies/Tone
  - Functional Muscle Testing
Clarifying Muscle Strength

- Muscle atrophy versus neuro impairment
- Motor recruitment
- Tone/Synergies
- At different points in the range
- Effects of gravity
- Neuro re-education
- What effect does core stability have?
  - Distal versus proximal issue
The Effects of Sensation

• Touch
• Proprioception
• Visual deficits
• Spatial deficits
• Balance
• Reaction to environment
• Reaction to movement
Motor

• Coordination
  – ataxia
• Balance
  – Reactions
• Synergies
• Reflexes
• Associated reactions
• Apraxia
Synergies

- Brunnstrom pg.16
Synergies

Figure 1-3  Flexion of the lower limb performed voluntarily. A. Spasticity in the knee extensors allows only initiation of the movement. B. Completion of full range of all components.
Figure 1-9 Associated reactions. A. Resisted elbow flexion on sound side evokes flexion response of hemiplegic upper limb. B. Resisted elbow extension evokes extension response. C. Resisted hip flexion on sound side evokes extension response of hemiplegic lower limb. D. Resisted hip extension evokes flexion response.
Homolateral Limb Synkinesis

Figure 1-10  Homolateral limb synkinesis influence on hemiplegic limbs. Flexion of lower limb evokes flexion of upper limb.
Apraxia

Problems adjusting hand movements for object manipulation (e.g., during hair brushing)

- Stroke Rehab pg
Figure 13-12  Performance component dysfunction manifested during feeding and eating tasks. 
A, Motor apraxia makes manipulation of knife difficult when buttering bread. B, Prefrontal 
perseveration. Man continues to move spoon toward glass instead of drinking from it, after having 
used the spoon to eat yogurt.

- Stroke Rehab pg. 318
Figure 13-12, cont'd  C, Spatial relations impairment. Woman attempts to stabilize a piece of bread but misjudges distances and grabs the side of the plate instead. D, Unilateral body neglect. Man does not attend to a piece of bread in left hand, hand slides unnoticed off table, and man grabs another slice with right hand. E, Unilateral spatial neglect. Man does not notice fork in his left visual field but solves problem by borrowing a fork from the next plate in the right visual field. F, Ideational apraxia. Man does not know what salt is used for and shakes it over butter container.
Tone/Spasticity
Our Understanding is Changing

- Good or bad
- To treat or not to treat
- Breaking up the synergy
- Facilitation
- Inhibition

*Decreasing spasticity alone doesn’t improve function*

Learned inhibition of antagonist vs. activation of antagonist
Other factors

• Cognition
  – Memory
  – Recognition of deficits
  – Impulsiveness

• Perception:
  – Neglect
  – Pusher

• Behavior

• Vision

• Language/ communication

• Dysphagia/ Swallowing
Rolling toward the unaffected side. The patient should avoid using the back extensors to bring the lower extremity forward while neglecting the hemiplegic arm (left hemiplegia).
FIGURE 25–2. A, Client with right hemiplegia. Movement deficit: weakness; client is able to walk with a brace and does not need a cane. B, During stance, his upper body moves laterally to the right and his right femur internally rotates as his knee hyperextends. C, He has enough trunk control to stand and balance and sufficient leg control to lift the leg with knee flexion.
Gait/ Stance


- Neurological Rehabilitation pg. 753
Gait/ Stance

FIGURE 25-1.  A. Client with right hemiplegia. Movement deficit: paralysis; client was unable to move arm or leg in standing or sitting. B. Client uses cane and tries to shift to right as he gets ready to step forward with left leg. Note how the heavy weight of the right side pulls the upper body into forward flexion and rotation left. C. Client prepares to step forward with right leg. Note that his attendant has corrected upper body position. D. Client leans heavily onto cane (upper body translates laterally to the left), to lessen weight on the leg. He will accomplish the “step” by rotating his upper body to left, a compensation for the loss of leg control in standing.
Gait/ Stance

- Neurological Rehabilitation pg. 754

**FIGURE 25-4.** Client with right hemiplegia. Severe compensatory patterns. She walks with a quad cane and standby assistance. Pelvis rotates to right, upper body rotates to left, hip flexes, and knee hyperextends. There is strong lateral translation of upper body to left (to the stable cane).
Sit to Stand

- Umphred pg. 757
Sit to Stand

**FIGURE 25-7.** A, Client with right hemiplegia with limited range in hamstring, tensor fasciae latae, and gastrocnemius/soleus muscles. B, Client has sufficient range at ankle to keep foot on the floor in sitting and as she initiates the rise to standing. C, As she stands and reaches the limit of range of these two muscle groups, her body compensates. The pelvis rotates right, and the tight medial hamstring adducts and internally rotates the femur and pulls the knee into extension as its medial insertion becomes more anterior to the joint. D, As the knee extends more, the calcaneus moves into equinus and varus. The foot supinates as a result of calcaneal varus and external tibial rotation from the tight tensor fasciae latae.

- Umphred pg. 759
Theories and Approaches
Rood

- Use of neurophysiological stimuli to facilitate and/or inhibit

- Developmental positions
  - Mobility: prone extension; supine limb movements
  - Stability: POE, Quadruped, Tall kneeling, Standing
  - Mobility on stability: weight shifts in stability positions
  - Skill: walking, running, jumping
Brunnstrom

- Thorough evaluation including speed tests
- Stages of recovery (1-7)
- Use synergies to get movements, then isolate out of synergy
  - Use of reflexes to activate synergies (movement)
  - Once synergies fully present, no longer use reflexes to reinforce
Speed Tests

• # of full strokes in 5 sec

Figure 2-8  Speed/coordination test, hand from lap to chin. A. Starting position. B. The hand is brought to the chin and returned to the starting position with as much speed as possible.
PNF

- Use of diagonal patterns
- Use of functional positions
- Sensory cues
  - Proprioceptive
  - Visual
  - Cutaneous
  - Auditory

*Figure 17-10* D1 lower extremity movement pattern moving into flexion. A. Starting position. B. Terminal position.
PNF Principles

- Manual contacts
- Position and movement of therapist
- Traction
- Approximation
- Stretch
- Timing for emphasis
- Maximal Resistance
- Reinforcement: verbal and visual cues
Techniques/ Terms:

- Initiate/ facilitate muscle activity:
  - Guided movement (GM)
  - Reciprocal Inhibition (RI)
  - Repeated Contractions (RC)

- Strengthen:
  - Slow Reversal (SR)
  - Slow Reverse Hold (SRH)
  - Agonist Reversal (AR) (strengthen)
Techniques/ Terms:

• Stabilization:
  – Alternating Isometrics (AI)
  – Rhythmic Stabilization (RS)

• ROM:
  – Contract Relax (CR)
  – Contract Relax Active Contraction (CRAC)
  – Hold Relax (HR)
  – Hold Relax Active Contraction (HRAC)
Quad- wt shifts = SR

Figure 8–13. Quadruped: weight shifting—slow reversals anterior/posterior shifts.
Sit to Stand - AR

Figure 10–21. Sit-to-stand transfers—agonist reversals.
NDT/Neuro-IFRAH

- Handling Techniques to control sensory input: Touch/ input is critical =
  - Inhibit spasticity
  - Inhibit abnormal reflexes
  - Inhibit abnormal movement patterns
  - Facilitate normal muscle tone
  - Facilitate equilibrium responses
  - Facilitate normal movement patterns

- Functional activities & positions
  - Use of automatic movement
  - Force hemi-side to work
  - Do not allow compensation although
Motor Learning

- Set of processes associated with **practice or experience** leading to a relatively **permanent change** in capacity to produce a **skill**
  - Process of the acquisition and/or modification of movement.

- Treatment Strategies:
  - Practice Scheduling
  - Specificity (movement vs goal)
  - Variability (transfer & context/ environment)
  - Cues, timing, & frequency of feedback
    - Extrinsic:
      - Verbal
      - Auditory
      - Physical
    - Intrinsic: patient awareness of own performance (cognition?)
Motor Learning

• Practice conditions:
  – Whole vs part
  – Massed vs distributed
  – Mental practice
  – Guidance from therapist
  • As soon as patient performing, therapist back off!
Motor Learning

- environment
- person
- task
Discussion: Approaches: pros & cons

- Rood
- Brunnstrom
- PNF
- NDT
- Motor Learning
Benefits of “Exercise”

• Supine position:
  – Initiate movement
  – Focus specifically on movement

• Standing/Parallel bars
  – Weight bearing
  – Weight shifts
  – Strengthening
  – Sensory input

• Examples:
  – Squats
  – Step ups
Muscle Memory/Neuro Recovery

**Why basic exercises alone don’t work**

- Motor recruitment/motor planning
- Compensatory strategies
- Muscle imbalance
  - Balance between the agonist and antagonist is essential for skilled, purposeful movement
- **300-400 reps for neuro recovery**
  - Think about athletes
- Isolated movements do not translate into function without help
  - Activity that directs attention away from the movement aspects of the task and toward a purposeful goal enhances neurological integration
  - The brain recognizes mass movement patterns over individual muscle activity
Why Traditional Exercises Don’t Work

• Proper recruitment of muscle
• Use of compensatory strategies
• Poor biofeedback
• Strength/endurance training alone do not drive neuroplastic change
Starting Treatment
Impairment-Based Approach

• Identify the impairments and address
  – Hip abductor weakness
  – Increased PF tone
  – Decreased ankle DF activity/ strength
  – Quad weakness: knee hyperextends or stays flexed
Motor Learning

Does training part of task transfer to the whole?

Yes, but not very well...not as well as practicing whole task
Motor Learning

Gait is continuous... should we break it into weight shifts & isolated muscle contractions?

- Used to do this. Can be some benefit.... standing and weight shifting = get used to being on hemi side again.... but not same as walking

- Get active DF in supine... is this same as in standing and stepping (gait)?
Motor Learning

- **Clinical Study:** Weinstein 1990 Effects of standing balance on hemiparetic pt (transfer of motor skills from one activity to another and part-to-whole training).

- Control subjects: standard PT = sitting balance activities, coordination exercises, muscle strengthening, weight shifting activities, standing balance activities
Motor Learning

- Experimental subjects: same plus specialized balance training with visual feedback trainer

- Results:
  1) all subjects improved standing balance but those with specialized training improved the most = proved this type of feedback effective for this balance task
  2) Some gait measures better for both groups but those who improved most with standing balance didn’t show big change in walking measures.
Motor Learning

• Therefore:
  – standing balance does NOT have a clear relationship to balance used during gait
  – standing balance and walking are different tasks; transfer from one to other is small (though may get improved transfer if tasks are similar)
  – tasks that appear similar have differences that aren’t always obvious
Motor Learning

• We can work on standing balance to improve standing balance but don’t expect it will improve walking or change gait pattern

• We need to:
  – categorize the movement:
    – gait is continuous, balance for walking is part of gait and can’t be separated from it = needs to be practiced all together
Motor Learning

• The effects of therapy:
  – many lead-up activities are practiced for gait (ex: supine, sitting, kneeling before actually stand and start walking in parallel bars
  – speed of gait is messed with: braiding, resisted gait
  – movements in positions other than standing are likely to be completely different movement tasks
  – slow movements and parallel bars have different requirements and are functionally unrelated
Motor Learning

• Before we toss out all other thoughts for RX….wait!!!

  – Weinstein’s study did show that person’s engaged in a thorough program **ALL** improved gait. This is a **positive** statement about effectiveness of Rx programs.
Initiating Movement: Neuro Re-Ed

- Central Pattern Generators
- Synergies
- Tapping/vibration
- PNF strategies
  - Stabilization, resisted movements, quick stretch
- Function
  - Use of automatic movements
- Limit the joints involved
- Weight Bearing
- Encourage affected side to work
- Joint compression
- Thera band
- Electrical stimulation
- BWSTT
Progression: Turning Movement into Function

- Body mechanics are key
- Increase the difficulty of the motor performance by:
  - Change position
  - Add resistance
  - Increase speed
  - Combining activities
  - Adding distraction
  - Increasing the number of joints involved
  - Changing the UE support
- Bilateral vs asymmetrical vs unilateral
- Isometric, eccentric, concentric
- PROM → AAROM → AROM → Resisted
Progression Parameters

- **Motor Learning**
  - Variability in practice
  - Practicing components of the movement
  - Task attention
  - Feedback
  - Environmental progression
- **Characteristics of the Movement**
  - Amplitude
  - Velocity
  - Amount of work
  - Endurance
- **Other Considerations**
  - Developmental sequence
  - Use of supportive devices
  - Assistance given

Adapted from The Aging Neuromuscular System
Hand position

- Manual contact
  - Resisting versus Assisting
  - Gentle vs firm vs assist
- Balance
- Motor function
- Tactile cues
Changing Positions

- Think about the effects of gravity
- Supine
- Side-lying
- Quadruped
- Tall kneeling
- Single knee kneeling/Half kneeling
- Standing perched/elevated surface
- Standing with B LE support
- Standing with single limb support
Transitional Movements

- Moving from one position to another
- Completing weight shifts within a position
- Completing dynamic tasks within a position
- Function based
The Role of Patient Fear

• Resisting versus Assisting
  – Balance
  – Motor
• Impaired sensory feedback
• Impaired awareness of COG over BOS

Use changes in the environment, support, and task to reduce the effects of fear
Gait

- Hard to take steps if you can’t stabilize
  - Breakdown the activity – but return to functional task
  - PBWS
- Pelvic control/trunk control
- Loading
- Terminal Stance
- Common gait abnormalities
  - Decreased heel strike
  - Genu recurvatum
  - Decreased contralateral step length
  - Decreased Wbing through ipsilateral extremity/decreased stance time
  - Decreased cadence
  - Circumduction/hip hike/swing phase impairments
Breaking Down Gait
In the Hemiplegic Population
Abnormal Gait Causes

Why is the abnormal pattern occurring?

- Decreased ROM
- Weakness
- Control/coordination problems
- Sensory disorder – COG over BOS or peripheral input
- Balance
- Vision
- Endurance
- Pain
- Stability
- Shock Absorption
- Forward Progression
Functional Tasks of Normal Gait

• Weight Acceptance
  – Stability
  – Shock Absorption
  – Forward progression

• Single Limb Support
  – Stability
  – Forward Progression

• Swing Limb Advancement
  – Foot Clearance
  – Limb Advancement
Impaired Heel Strike

- PF contracture
- Increased activation of PFs
- Decreased activation of DFs
- Decreased knee extension during terminal swing
  - Decreased quads
  - Increased hamstrings
  - Flexion synergy
  - Incoordination
  - Decreased ROM
  - Decreased hip extension
Genu Recurvatum

- Excessive PF (overactive PFs or decreased ROM)
- Overactive quads
- Decreased co-contraction of hamstrings
- Compensated stability for weak knee extensors or hip extensors
- Need to get anterior tibial translation! TIBIA OVER FOOT
Decreased Contralateral Step Length

- Impaired ipsilateral stance
- Fear of Wbing through ipsilateral limb
Impaired Ipsilateral Stance

- Fear of Wbing
- Impaired COG over BOS awareness
- Decreased hip ext/PF strength
- Decreased hip ext ROM or DF ROM
- Excessive forward flexion
  - Flexed postures usually due to hip extension and PF weakness
- Hip abduction weakness/incoordination for pelvic stability
Decreased Cadence

- Coordination
- Motor planning
- Patient anxiety
- Impairments in parts of the gait cycle
Swing Phase Impairments
Vaulting, Circumduction, Hip Hike, Lateral Trunk Lean, Steppage

- Looking for clearance – will get it anyway they can
- Poor set-up in terminal stance
  - Hip extension joint position to activate CPGs
    - look at hip flex and pelvic positioning
  - Hip flex and PF AROM to initiate swing
  - Watch ER of the LE
- Inability to DF properly (ROM, strength)
- Incoordination
- Activation of extensor synergies
Missing Gait Principles

• Knee flex during swing is initiated by hip flex and PF
  – Need a good trailing limb in terminal stance

• Initial stance requires a high torque on hip extensors
  – Weak hip extension can cause lots of compensations

• Good heel strike significantly reduces the likelihood of clonus

• Poor stance phases usually account for most gait abnormalities
  – Need hip abduction during single limb support and loading response

• Hemiplegic gait patterns are significantly less efficient
Orthotics

• Static versus Dynamic bracing: To move or not to move
  – Movement has to come from somewhere
• Is it enough or too much?
• Working outside the brace
• Getting something different
• Shoe inserts
  – Support
  – Tone management
• SMO (Supramalleolar)
• AFOs
  – Anterior tibial translation
  – Rancho Decision Making Tree
• Incorporating the knee
  – Swedish knee cage
  – KAFO
What Ortho PTs do better

• Manual treatments
  – Joint Mobilization
  – Myofascial
  – Strain/Counter strain
• Strength training
• Cardiopulmonary – Aerobic training!!!!!!
• Proprioceptive training
• Kinematics and relation to overuse injuries
• Taping
Basic Principles of NMRE

• Normalize movements
  – Use support, environmental changes, and alternative interventions as needed
• Limit compensation
• Use peripheral input to stimulate central changes
• Reinforcement/Repetitions
• FUNCTION, habit, automatic movements
• Training must be skilled
• Encourage use and avoid disuse
• Encourage client control
• Build a foundation, set them up for success
  – Wbing, initiation, core/pelvis, body mechanics

“First make it possible, then make it happen” - Bobath
Interventions

- Developmental Positions
Cueing

- Too much
- Too little
- Types
Assessment of Techniques

• Are you getting what you want?
  – Don’t want to trade one issue for another

• Increasing difficulty

• Decreasing support

• Changing activities

• Symmetrical
Treatment Ideas

- Weight Bearing
- Quick stretch
- Change positions to effect gravity and weight bearing
- Elevated surfaces
- Transitional movements
  - Lots of options from scooting to stepping
- Tackle more than one thing at a time
- Mirrors/Motor Imagery
  - Enhance symmetry
  - Reduce substitutions
- Scale
- Give lots of feedback
- Limit cues
- FUNCTION FUNCTION FUNCTION
- Open vs closed chain activities
- Coordination/targeting activities
  - Ex: Cones
- Aerobic Training
- There is no one size fits all
- Forced Use/Constrain-Induced
- Increasing speed/timing and complexity/coordination
- Taping
  - Feedback component
  - Decreased attention
  - Active assist
- Theraband
- Ace Wrap
- Weighted extremity
- Skate
- BWSTT (Body Weight Supported Treadmill Training)
- Incorporating the trunk and UE
- Increased use of the extremity
  - Bridging, standing, etc. with forced activity
  - Constraint induced therapy
- Strengthening
  - Resistive training
  - Closed chain
  - Isometric, eccentric, concentric
  - Slowly add gravity or weight bearing as appropriate
  - Bilateral vs asymmetrical vs unilateral
Weight Bearing/Closed-Chain

• Fear
• Sensory Impairments
• Perceptual Impairments
• Motor planning/recruitment issues
• Muscle imbalances
• Weight shifting in all directions and different foot positions
• Joint compression
• Developmental Positions
  – POE
  – Quadruped
  – Tall kneeling
  – Single knee kneeling/half kneeling
  – Standing
  – Unweighted standing
  – Transitional movements
Shaping the Task

• Force the activity that you want to get the response you want
  • Constraint of unaffected side
  • Muscle activation must occur to complete task
  • Use of appropriate physical cues/input/support

• Breakdown the components of a functional task
  – Need to always return to the functional task

• Gradually increase the difficulty or complexity of the activity

• Feedback necessary
  – Avoid compensations/substitutions
  – Enhance what you are training
Proprioceptive Training

- Weight bearing
- Joint approximation
- Application of resistance
Quality versus Quantity

• Continuous movement for CPGs
• Breaking down movement patterns into components (building a base)
• Mechanics of movement
  – Orthopedic injury prevention
Creating New Habits

How many reps and sets?

• Reps important, but quality more important
• Neuroplasticity requires A LOT of repetition
• Move on when the client “gets it”
• Start adding the pieces together/increasing difficulty
  – Ex: change position
Always Return to Function

- Meaningful
- Reps increase
The Vestibular System
Home Exercise Programs

• Structure exercises to minimize compensation
• Make it a part of their day rather than specific exercises whenever possible
• Need to know how to activate the muscles properly first
• What is important to them
Upper Extremity

• Needed for function
• Needed for balance during gait
• Similar principles apply
• INCORPORATE!
• Scapular mobilization may improve trunk mobility
Objective Measures for Strokes
Track meaningful progress, justify services, educate clients, predictive value

- **Function**
  - Rivermead Motor Assessment (RMA)
  - Stroke Impact Scale
    - Self-Assessment tool
  - 5 Times Sit to stand Test
  - Fugl-Meyer Assessment (FMA)
    - There is a motor only component
  - Stroke Adapted Sickness Impact profile (SA-SIP-30)
    - Self-Assessment Tool
  - Stroke Rehabilitation Assessment of Movement (STREAM)
    - Good focus on each limb movement
  - Assessment of Life Habits (LIFE-H)
    - Self-Assessment Tool

- **Gait**
  - 6 Minute Walk (6MWT)
  - Timed up and go (TUG)
  - Dynamic Gait Index
  - 10 meter walk

- **Balance**
  - BERG (BBS)
  - Activities-Specific Balance Confidence Test
    - Self-assessment tool
  - Trunk Impairment Scale (TIS)
  - Postural Assessment Scale for Stroke Patients (PASS)
    - Good for tracking progress in moderate to severe strokes

- **Upper Extremity**
  - Action Research Arm Test (ARAT)
  - Functional Reach
  - 9 hole peg Test
  - Arm Motor Ability Test (AMAT)
  - Dynamometry
  - Box and Blocks Test
www.neuropt.org

• EDGE recommendations:
Take Away

- Kinematics
  - Ex: Tibia over Toes
- Weight Bearing/Closed-Chain
- Normalization vs Compensation
Just Give Me 5
What do you struggle with treating?
Lab Activities

- Ace wrap/Theraband
- Handling techniques
- Transitional movements
- Step-ups
- Scale
- Skate
- Developmental Positions
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